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FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

Official Organ of the Royal Aero Club First Aeronautical Weekly in the World Founded 1909

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Open Challenge, Open Columns

AT the recent Court and Livery Dinner of the Worshipful Company of Coachmakers and Coach Harness Makers of London, Lord Brabazon told the assembly that he had written a letter to "one of the aeronautical journals" concerning the kerosine v. JP.4 fuel controversy. The journal was *Flight*, and the letter appeared in the issue of October 7. Most readers will recall that it issued a challenge to a "fuel duel" between Lord Brabazon and protagonists of JP.4.

While air safety, particularly where the fire hazard is concerned, is not the most suitable topic for sensational or emotional publicity, Lord Brabazon's letter was calculated to attract public attention to a situation which must increasingly concern all who operate, or travel by, turbine-engined airliners.

Curiously, neither the air correspondents of the daily Press nor the BBC took notice of Lord Brabazon's challenge, though one writer admitted a personalized version to his column. Certainly the literature of the subject appears one-sided and inadequate. Perhaps the first contribution to discussion, and certainly the best known, was an article in *Flight* of June 10 last, described by Lord Brabazon as "unanswerable." Since that time we have reported successive developments in the situation, the latest being an MoA order reducing from fourteen to eleven the number of aircraft permitted on the London Airport North apron at any one time, by reason of "the increased danger of fire from mixture fuels." This Ministerial allegation is described by Pan American as "quite ridiculous."

Our columns are at the disposal not only of the apostles of kerosine but also of the increasing band of converts to JP.4.

Into Orbit Modestly

BEHIND the recent clamour for and against a major all-British space programme, a group of scientists at three Redbrick universities have been quietly getting on with the job of designing, developing and refining equipment for a modest set of orbital experiments. The object of their attentions is revealed, for the first time in any publication on either side of the Atlantic, on page 631 of this issue. It is the first Anglo-American satellite—in effect a United States satellite carrying British instruments—which has been made possible by the enlightened international policy of the US National Aeronautics and Space Administration.

Nobody would wish to suggest that the orbital rides now being offered in America's satellite streetcars are in any way a substitute for a thriving rocket technology in this country, embracing launch vehicles and spacecraft. But the modest efforts of the university physicists in London, Birmingham and Leicester are dedicated to a more basic and worthwhile ideal than that of the obsessional nationalism shown by many of the go-it-alone, regardless-of-expense brigade.

From the scientific viewpoint it does not matter one iota who makes the important discoveries in the exploration of space. What matters is that these discoveries shall be made. And the most effective way of ensuring this, simply because space is an expensive place, is by international co-operation. Sooner or later this will happen on the widest scale. Most scientists, and others who take a far-sighted view, realize this now. International 1 is a worthy first step as far as this country and the United States are concerned, and the indications are that the initially planned trio of launchings under this scheme will be followed by others. But, whatever might be achieved in the future, International 1 is being achieved right now. Science, and this country, will be the better for it.

FROM ALL QUARTERS

General Aviation: Air League Report

ISSUED this week, the four brief pages of *The Air League Report on General Aviation* shame previous public utterances by this long-established British aviation advisory body. Under the chairmanship of The Hon Hugh Astor, Gp Capt Douglas Bader, The Hon Anthony Cayzer, Mr Peter Brooks and Air Cdre G. J. C. Paul, the committee (and Air League) secretary, have succeeded in compounding a powerful amalgam of ideas recently put forward for lifting British private flying from its doldrums. Among the League's sources of reference appear to have been the Royal Aero Club, and *Flight's* "Sport and Business" columns.

From their analysis of general aviation's woes the Air League conclude that the absence of any permanent department to advise the Minister is "fundamentally wrong" and one of the "basic causes of the difficulties" which have led to the United Kingdom lagging so far behind the United States or its nearer neighbour, France. This fundamental lack has led, they report, to shortages of airfields and ground facilities; of aircraft, except for imported types; of the radio equipment which is "absolutely essential under modern conditions"; and of written guidance for the non-professional pilot.

The League recommends Government action on several fronts, pleads for "one voice" in general aviation, and makes the rather vague suggestion that R/T should be accepted as a minimum requirement "within a reasonable period." The Government, the report demands, should declare a policy aimed at the expansion of general aviation. An MoA department should also be established to implement this policy. This is "the single most important step" necessary for general aviation's growth and well being. Also recommended is the formulation of a national aerodrome and ground facilities policy. Under this heading are raised such well-thumbed ideas as common frequencies for private pilots, use of RAF airfields at weekends, better access for private pilots through control zones in IMC, and free airspace everywhere below 1,500ft except in the vicinity of big airports.

The League are for Government encouragement of private enterprise in the manufacture of light aircraft and against aviation fuel tax and import duties on aircraft and equipment—at least for two or three years.

Finally. they bravely attempt to define *why* Great Britain should have private and business aviation at all. It is, they conclude, because it offers convenience and economy to the industry; it creates an industry in the design and construction of engines, airframes and radio; it opens up new export markets and it fosters airmindedness. "General aviation," says one of the best sentences in the report, "comprises sectors of any nation's total aviation activities which are so important as to jeopardize the remainder if they remain too long neglected."

DINNER PARTY for Sir Matthew Slattery, who resigned the chairmanship of Shorts for that of BOAC. Sir Matthew received a silver salver and is seen with (standing) Mr R. Boorman, chief technical engineer, and Mr R. E. Harvey, joint deputy managing director; (seated, left) Mr C. P. T. Lipscombe, a former director and (right) Mr D. Keith-Lucas, the company's technical director

Beagle Figures

THE chairman of the Pressed Steel Co Ltd, Mr Alexander Abel-Smith, is reported as having stated that the BEAGLE Group intend to produce a 4/5-seater executive aircraft to sell at "around £25,000." Earlier, the group had declined to release any information whatever on the new aircraft.

Mirage IIIs for Switzerland?

AFTER evaluating several possible types of fighter-bomber, the Swiss Air Force has decided in favour of the Dassault Mirage III; but no order has yet been placed, and whether one will be depends (writes a correspondent) on a Parliamentary decision as to whether the air force is to retain a front-line strength of 400 aircraft or is to be reduced in size. For Swiss use, the Mirage would be equipped with a newer and stronger airframe and an arrester hook.

Ivor Jehu

WE record with regret that Mr Ivor Stewart Jehu, CIE, Chief Information Officer at the Ministry of Aviation, died suddenly a fortnight ago at the age of 51. Before the MoA was formed, he had been with the Ministry of Supply since 1952.

He began his journalistic career on the *Glasgow Herald* in 1931, subsequently becoming Indian correspondent for several British newspapers. During the war he became Director of Public Relations, India Command, and was released from military service in 1945 with the rank of brigadier. From 1948 to 1950 he edited the *Times of India*, then after returning to this country joined the National Coal Board before going to the Ministry of Supply.

WING-WALKING, favourite act in the barnstorming days, still survives. French stunt-man Gil Delamare demonstrated it on a Fieseler Fi 156C Storch at a recent Barcelona display

New Hope for Croydon?

FURTHER efforts were made last week by the Royal Aero Club and the Croydon Chamber of Commerce to secure the reopening of Croydon Airport as a general-aviation aerodrome for executive and private aircraft. Arguments in support of this were put forward at a public inquiry into the future of the airport site, held at Wallington, Surrey, on October 12-14.

Mr Peter G. Masefield, speaking as chairman of the aviation committee of the Royal Aero Club, said that the aerodrome which the club wished to see at Croydon would not be used for scheduled air transport, nor for club training. The business and private flying activity envisaged would not require the whole of the existing airport area: "There would be sufficient room available, within the present airport boundaries, for not only adequate grass runways for business aviation, but also—with safety—for playing fields, a shopping centre and for industrial development."

The growth of business aviation in Britain, Mr Masefield said, was being hampered "and even hamstrung" by the shortage of airfields. New York had twelve landing fields within 15 miles of the city centre; Paris had six; and London had none.

Croydon was ideally suited to be London's executive airport for five reasons: (1) it had rapid access to London by public surface transport; (2) it was conveniently located for access by air from the Continent; (3) it had good terminal and hangar facilities; (4) it had restaurant and hotel facilities; and (5) it had Customs amenities. Mr Masefield continued: "All these five requirements exist uniquely at Croydon. They can be achieved nowhere else—except, perhaps, at vast cost . . . And I understand that—subject to the findings of this inquiry—the Ministry of Aviation is not likely to have objections to the use of Croydon as a privately operated airfield for business, executive and private flying . . .

"There are concerns now ready and willing to come forward with the necessary funds to buy and to operate Croydon as a licensed business aerodrome . . . We have here a tremendous opportunity for wise and imaginative planning. We can establish

ONE OF TWO Fiat G.91s which recently flew from Turin appears in this picture from Bristol Siddeley's Patchway works. Tom Frost, chief test pilot, is seen with Maj E. Ferretti (left) and Capt F. Bonazzi (right). Both are employed on experimental flying at the Pratica di Mare, Italy's "Boscombe"

a new centre for business flying where aircraft from all over the UK, and indeed from all over the world, can make their contacts with London. We can build here on old traditions. And we can combine with this imaginative new requirement the needs for shopping centres, playing fields and the other developments for which there is adequate room. This is indeed a forward-looking plan. And I stress that it is a national requirement on the highest level—an opportunity which we cannot let pass—a demonstration of our faith in the future of our country."

Among other supporting speakers at the inquiry were Lord Brabazon of Tara, president of the Royal Aero Club; and Wg Cdr T. A. Vigors, managing director of Vigors Aviation.

New Polish Aircraft

TWO new Polish aircraft made appearances at an air display at Lodz recently, one of them—the TS-11 Iskra (Spark) two-seat operational trainer—being seen in public for the first time. The other was the S-2 five-seat helicopter, a Polish development of the Russian SM-1 (Mi-1).

Designed by Ing Dipl Tadeusz Soltyk, Iskra is the first jet aircraft of original Polish design, powered by a Polish engine reputedly of 1,300lb static thrust. Unsuccessful attempts were made to obtain a suitable engine abroad, the Bristol Siddeley Viper being a possibility, and construction of the prototype was delayed until a powerplant was available at home. No information concerning the aircraft's construction or performance has so far been released; but a correspondent reports that the Iskra "looks rather like a scaled-up Temco Pinto"—provisional artist's impression, *Flight*, December 27, 1957—and "carries extensive radar equipment in the nose." It is expected that it will be ordered by the Polish Air Force and also offered for export.

The S-2 helicopter which appeared at Lodz is described in relation to the SM-1 as having a completely re-designed and roomier forward fuselage and a number of structural improvements, which have resulted in an empty weight of 1,815kg (4,000lb) —85kg (187lb) less than the comparative figure for the SM-1. Maximum speed is said to be 160km/hr (99.5 m.p.h.) and hovering ceiling 2,000m (6,560ft).

IN BRIEF

The Minister of Defence, Mr Harold Watkinson, last Friday visited A. V. Roe & Co Ltd at Woodford and Blackburn Aircraft Ltd at Brough.

According to a London daily newspaper, Genie, the nuclear-tipped air-to-air rocket of the USAF, is to be procured for the RAF. Already, the paper claims, the Lightning has been modified to launch this weapon.

The Brazilian aircraft carrier *Minas Gerais*, formerly HMS *Vengeance*, arrived at Portsmouth on October 13. She has recently been modernized and fitted with an angled deck and is to carry out flying trials in the English Channel.

A method of automatic control of approach speed by variation of the cross-section of the tailpipe orifice has been developed by SNECMA in France and applied to Atar 9 turbojets installed in the SE Durandal prototype and a Mirage III.

Three black mice were carried in the nosecone of an Atlas launched from Cape Canaveral on October 13 in a ballistic trajectory with a range of 5,000 miles and an altitude of 700 miles—a record height for animal space-travellers. Named Sally, Amy and Moe (their initials standing for the School of Aviation Medicine at Brooks AFB, Texas), the mice rode in separate compartments in a 16in, 6in diameter cylinder, and were recovered in good physical condition. Test objective was to determine how the mice were affected by confinement in a small space, weightlessness, high gravity forces during acceleration and re-entry, noise and radiation.

COTTON SPRAYER: One of two Prospectors operating in the Sudan (the other belongs to Air A.D.S.), this machine was recently handed over to Crop Culture (Sudan) Ltd for cotton spraying. The engine is a 295 h.p. Lycoming

A USAF navigator, Lt George J. Nagy, has just completed 200 ski landings on the Greenland ice cap in Hercules C-130D transports.

Mr John Byrne, a director of de Havilland Aircraft (Pty) Ltd at Bankstown, NSW, Australia, is retiring after 30 years' service.

Senor Ing R. Patron, Peruvian Minister without portfolio, recently visited the factory of the Bristol Division of Westland Aircraft Ltd at Weston-super-Mare.

M Pierre Satre, technical director of Sud-Aviation, was presented with the FAI Gold Medal during the Fédération's general-assembly meeting in Barcelona recently.

The Council of the SBAC, "after considering the satisfactory results of last month's Flying Display and Exhibition," have decided that the next in the series will be held in the first full week of September 1961.

The first Canadian company to operate a Lockheed Jetstar on executive duties will be the Toronto department store group T. Eaton & Co Ltd. Delivery is to be made in mid-1961.

Five Morane-Saulnier 760 Paris aircraft have been ordered by the Peruvian Government. To be used in aerial photography, they are being delivered this year.

"Productivity" is the main theme of next month's convention of the Scientific Instrument Manufacturers' Association of Great Britain, being held at Eastbourne from November 17 to 20.

The Dutch Government are ordering 15 Lockheed P2V-7s, at a cost of Fls. 88m (£8.3m). These aircraft will replace the Martin Mariners recently withdrawn from Dutch New Guinea.

United Aircraft Corporation, East Hartford, Conn, has acquired a 20 per cent interest in Société Precilec, a French electronics manufacturing company, and an equal interest in Société Somalec, an engineering organization associated with Precilec.

An aviation display "on the lines of the SBAC Show at Farnborough" is to be held at Palmerston North Airport, New Zealand, in February 1962. The project has the support of the NZ Civil Aviation Administration and Aviation Industry Association.

As we go to press it is reported unofficially that an Anglo-US agreement will shortly be signed under the terms of which a UK naval base —possibly in Northern Scotland—will become the home of *USS Proteus*, mother ship to the fleet of Polaris-armed FBM submarines. This should minimize the time which these submarines will spend in transit, and should permit more than half the total force to be on station at any time.

Two more London Motor Show special issues are being published by our associated journal *The Autocar*. Today's (October 21) is a Show Report number, and the Show Review will appear next week.

Translating into Service

Belvederes for RAF Trials Unit

ON Thursday of last week, at Westland's Bristol Division airfield, Weston-super-Mare, Mr D. C. Collins (deputy managing director of Westland Aircraft) handed over the first three production Westland Belvederes to Sqn Ldr J. R. Dowling, CO of the Belvedere Trials Unit. Operational trials are to be at RAF Odiham, and the first squadron will be formed for overseas service late next summer.

During a brief demonstration after the ceremony all three Belvederes simultaneously started first their rear and then their forward Napier Gazelle engines with i.p.n. starters, took off respectively backwards, sideways and forwards, and flew past in line astern, before hovering in line abreast and landing. Belvederes are the first turbine-powered, the first twin-engined and the first twin-rotor helicopters to go into RAF service. One machine established records between London and Rome (118 m.p.h.) and London and Malta (115 m.p.h.) last June while on its way to Idris for tropical trials. The type has a gross weight of 18,500lb, maximum cruising speed of 120kt, hovering ceiling in and out of ground effect of 11,000ft and 7,600ft respectively, and a range of 400 n.m. on standard tankage. Maximum payload is 6,000lb, carried either internally or externally.

These first three machines have wooden rotor blades and manual controls, but true production versions will have untapered metal blades and powered controls and, possibly, autostabilizers. The anhedral tailplanes—later machines will have double-anhedral instead of straight surfaces—reduce rolling moment with sideslip and the machine can be comfortably flown manually at high speeds without stability augmentation. The r.p.m. of the free-turbine transmission and rotors is manually maintained by a linked collective-pitch lever and throttle twist-grip and, if one engine loses power, the other is immediately brought to twice the power at which it was operating, or to the 1,650 h.p. maximum contingency rating, whichever is the lower. Loss of torque in one engine activates a dump valve to shut down that engine and supplies an electrical signal to speed up the other engine. The pilot will notice only a change in torque-meter readings and a red light, and will have no asymmetric conditions or control adjustments. The r.p.m. will return to normal in 2sec. Should one engine fail, the Belvedere can hover at gross weight in the ground cushion or can be translated into climbing flight with a height loss of less than 50ft. Only 1,000 of the available 1,250 h.p. continuous output of each engine is normally used, so that full power can be restored at height.

"Flight" photographs

Above, Mr D. C. Collins, Westland deputy managing director, hands over three Belvederes to Sqn Ldr J. R. Dowling, CO of the Belvedere Trials Unit. At top left, the three machines hover together. Below, Flg Off J. H. Martin presents a Belvedere at 80kt over Weston-super-Mare for photographer L. W. McLaren in "Flight's" Gemini

STREETCAR SATELLITE

First Anglo-American Spacecraft to be Prototype All-purpose Vehicle

THE strange new shape above is that of the vehicle in which scientific experiments from Birmingham University, Imperial College and University College, London, will next year get their first taste of space. Illustrated here in detail for the first time in any publication, the satellite design has now been confirmed and teams on both sides of the Atlantic are well advanced with detail work on the project.

Known in the United States as S-51 or International 1, and in this country as UK Scout 1, the satellite is the joint responsibility of the US National Aeronautics and Space Administration and the Royal Society. The broad division of responsibility is that the British University groups (coordinated by the Royal Society's National Committee on Space Research) are developing the scientific instrumentation for the selected experiments: and NASA is providing the telemetry, power sources, the actual satellite structure into which these will be integrated with the British equipment, and the launch vehicle and facilities. Data obtained from the satellite will be received and processed by NASA and sent to Britain for final interpretation.

Two project managers, one in each country, are handling the overall guidance of the programme. They are Mr R. C. Baumann of NASA's Goddard Space Flight Center, Greenbelt, Maryland, and Mr M. O. Robins, a Ministry of Aviation scientist attached to the Royal Society for work with Prof Sir Harrie Massey at University College, London. Periodic joint working group meetings are held at which progress is reviewed by the American and British teams; the most recent of these was held in London during September 26-30.

The satellite structure consists basically of a 23in diameter, 10in deep central cylinder fitted with a hemisphere at each end, the lower one carrying four solar-cell "paddles." Two narrow booms extend from opposite sides of the structure, and at the upper end a 4in diameter sphere is carried on a short cylindrical support. The overall philosophy of the design team at the Goddard Center has been to produce a useful "streetcar" type of satellite, i.e. a standardized vehicle which can be used for a variety of groups of scientific "passengers" as required. Weighing 150lb, the satellite will have a 55° orbit (perigee and apogee 200 and 600 miles).

The launching vehicle will be the four-stage, solid-propellant Scout, details of which are included in this week's Missiles and Spaceflight section (page 636). The NASA project group responsible for the development of this vehicle is located at Langley Research Center and is headed by Mr William E. Stoney Jr. The cost of a Scout vehicle, assembled, checked and delivered, is approximately $750,000. Launching costs are additional and, at the current rate of launching, amount to a further $150,000. With an increase in launching rate to 15-20 per year, however, this figure would be reduced considerably.

As has been reported previously in *Flight*, the overall object of the British experiments, with one exception, is the study of the ionosphere. In the picture the features are as follows:—

The two discs at the end of the right-hand boom are the parallel plates of a capacitor used by the Birmingham University team led by Prof J. Sayers to explore the local spatial electron density.

At the end of the opposite boom is a disc-shaped probe used in the University College electron temperature experiment. This, in fact, is a duplication of an experiment in the satellite body employing a flush-mounted disc in the skin, the object being to take advantage of what would otherwise be a balance boom.

The cylinder on which the small sphere is mounted—but not the sphere itself—contains equipment for the determination of the primary cosmic-ray energy spectrum. The only non-ionospheric experiment to be included, this is directed by Prof H. Elliott of Imperial College. Hardware for this experiment was exhibited at the SBAC Show by McMichael Radio (*Flight*, September 16, page 460).

The small sphere is the outer (negatively charged) screen surrounding the positively biassed ball used in the University College determination of the ion mass spectrum.

Four skin-mounted sensors are visible. The lower one is for the UCL electron temperature measurement. The remaining three are also by University College, and are concerned with the study of electron concentration and of solar radiation (ultra-violet and X-ray spectrum). This College's work comes under Dr R. L. F. Boyd and Dr A. P. Willmore; the X-ray measurement is in collaboration with the University of Leicester, with electronics package designed by the Guided Weapons Division of Bristol Aircraft; and the circuitry for the electron density and temperature experiments has been designed by Pye Ltd.

The satellite will be spin-stabilized in orbit, and is expected to have a lifetime of one year. Automatic cut-off of data transmission after this period will probably be incorporated. Interior electronics equipment is entirely transistorized and is constructed in 5½in diameter circular "cards" or modules which are mounted on a central shaft. Printed circuitry is employed in the modules, which will be foam potted for protection against acceleration and vibration.

K. T. O.

A symbol of national pride and airline adulthood—PIA's Boeing 707 taking off from Karachi

PIA Profile

An Assessment of Pakistan's Airline: Part 1—On the Route to Europe

BY ALASTAIR PUGH

THAT famous old Karachi landmark, the R101 airship hangar, is being pulled down. Meanwhile, the national airline, PIA, is operating in its own colours a Boeing 707 on the service to London. If the former event is of symbolic interest, the latter has a more tangible significance. Here is a first-hand report on the Boeing operation from a member of "Flight's" staff recently in Pakistan.

THEY say that when the first Boeing 707 on trip lease from PanAm to Pakistan International Airlines reached Karachi, a crowd of several thousand turned up to cheer it in. That was at two o'clock in the morning, in March, eight months before a 707 appeared in PIA's colours of turquoise with white stars.

Perhaps the Karachians were then better aware than the airline that this was to be a turning point in PIA's international fortunes. The first stage of the Boeing operation is an airline success story, and the aircraft-lease and three-times-a-week service that began on October 4 could consolidate the impetus that a big jet has given to a not-so-large airline.

When the Boeing was first introduced, the Karachi - London Constellation service had an unhappy name for lax timekeeping and frequent technical delays. Every airline is fair bait in the cruel "initials" game but "Perhaps I'll Arrive" and "Please Inform Allah" were gibes that with some justification were taken to heart by the airline's new management under Air Cdre Nur Khan. So introduction of a 120 seats-a-week-each-way Boeing service was not only a manifestation of Pakistan's aspirations for its international flag carrier, but an act of faith by a management that had for the first time just turned the corner into profitability.

Seven months of trip-lease operation brought a profit of 14 lakhs of rupees (about £110,000), about twice that budgeted. When the service started, PIA estimated that their costs would be 11,000 Rs (£850) an hour and that they would break even if they could carry 47 passengers plus normal freight and mail. Although this was an underestimate—additional training hours raised hourly costs to just over £920 an hour—good load factors have more than compensated for the additional charges. Two reasons for this are PIA's remarkable improvement in regularity and punctuality, and their good cabin service. Ex-Karachi, only on three occasions this summer has the Boeing been late departing or arriving in London. And although relatively new to airline catering, PIA's cabin crews blend with capable PanAm training a natural Pakistani courtesy. In an era when synthetic goodwill appears to be replacing a real willingness to please, such genuinely gracious service is refreshing.

The trip-hire and aircraft-hire arrangement with PanAm is entirely a business agreement. No pooling is involved and the only string to the deal was endorsement by PIA of PanAm's request to the Pakistan Government for traffic-rights for its round-the-world service.

From March until October 4, PIA leased PanAm 707s ex-London for one return service a week. The aircraft were, of course, in PanAm colours. While Pakistani crews were training, the aircraft—707-321s and 331s taken over by PanAm from TWA, some with modified fins and some without—were flown by PanAm pilots and engineers. Sari-uniformed stewardesses and Pakistani stewards were employed from the outset, although a PIA sticker on the fin was the only outward sign that this was not a PanAm service. It was added at the behest of the MoA, who asked for visual evidence that this was a PIA operation and not a PanAm "beyond" service out of London over PIA's routes.

On October 4 a new arrangement came into effect whereby PIA leased from PanAm one specific 707-320, now for the first time in PIA colours. This Boeing 707 operates three London-Karachi return services a week, tripling PIA's jet capacity, and doubling the number of available seats. The replaced Super Constellations now swell the capacity on the East-West Pakistan domestic link. Under the aircraft lease the Boeing is again taken on an hourly basis, maintenance being conducted by PanAm at New York, at London, at the route stations or by PanAm's maintenance organization at Karachi. The interchange becomes complete when PanAm crews return the PIA aircraft to New York for overhaul on one of their normal services, and an aircraft in PanAm markings is again temporarily leased to PIA.

All maintenance costs and depreciation charges are met by PanAm and the hourly charge is calculated to provide a seven per cent return on this investment. Other operational costs—fuel, crew salaries and handling charges—are met by PIA. The whole arrangement was the outcome of one of those informal meetings which justify the presence of senior airline management at IATA a.g.m.s—in this case at Tokyo in 1959. Detailed, "most equitable," negotiations at Karachi followed, but it is a reflection upon the very wide powers vested in Air Cdre Nur Khan, the airline's managing director, that operation followed only six months after the idea was broached. Overhaul of PIA's management structure when the air commodore took over early in 1959 provided him with an almost free hand to conduct negotiations personally, reference to the five board members who are government officials being made only on a month-to-month reporting basis. In Pakistan the airline hierarchy descends directly from the president, Ayub Khan, via the Ministry of Defence, the Air Force and the directorate of civil aviation. PIA's ex-PAF managing director enjoys direct backing from the president. Where previously policy decisions involved a lengthy chain of government departments, they are now taken and implemented by one man. Two manifestations of this are in preparation of the report and accounts, which in the past lagged by over two years, and in the placing of the order for the Fokker Friendships which are to operate in East Pakistan from early next year. Negotiations were concluded in one month.

Protagonists of Commonwealth solidarity may ask why PIA should turn for airline assistance to the US instead of to the UK, particularly in view of BOAC's *rapport* with Air-India and Qantas.

(Concluded on page 655)

Republic F-105D on the flight line at Farmingdale, Long Island. The type entered service with USAF Tactical Air Command last May

By Kenneth Owen

RADAR and RESEARCH

FINAL instalment of a report of an official tour of United States defence facilities, this article covers visits to Republic Aviation at Farmingdale, Long Island, and to Radio Corporation of America at Camden and Moorestown, New Jersey. An expansion of research and development in the space field by Republic is described, and details are given of the RCA Ballistic Missile Early Warning System installation planned for Fylingdales Moor, Yorkshire.

AN aircraft firm with an impressive production record which is staking its entry into spaceflight with a sizeable increase in research and development effort, Republic Aviation Corporation at Farmingdale, Long Island, had much to show and describe to us during our brief visit. Company news can be grouped under three main headings: current F-105 Thunderchief production, ideas for future aircraft, and research and development.

First flight of the F-105D all-weather version of the Thunderchief took place in June 1959; the type began an extensive flight-test programme at Eglin AFB, Florida, in January 1960; and the first D was delivered to Tactical Air Command of the USAF on May 17 last. At the time of our visit to the Farmingdale production line at the beginning of this month, over 100 D models had been built of a total order which exceeds 300.

Already described in detail in *Flight* (June 12, 1959 and July 8, 1960), the 105D is notable for the extent of automatic flight which is made possible by the integration of AN/APN-131 doppler navigation system, NASSAR R-14A radar, FC-5 flight control system and AN/ASG-19 "Thunderstick" fire-control system. As a typical example, a flight from Farmingdale by Republic test pilot Carl Ardery was described by the company as follows:—

"Ardery took off from Farmingdale and climbed to 35,000ft, where he engaged the aircraft's altitude-hold to level the ship. Then he set the doppler navigator, which banked the aircraft into a turn until it reached the proper destination heading and automatically rolled out on its course to the target.

"Flying hands-off at 680 m.p.h., Ardery turned on the aircraft's Mach-hold instrument, for constant speed, and descended to 5,000ft, 80 miles from his target, in preparation for an over-the-shoulder low-altitude bomb-toss manœuvre. A simulated bomb release was executed by the aircraft's 'Thunderstick' fire control system, which then half-looped the ship on its escape path, rolled it into normal attitude and headed it back to Farmingdale.

"The entire mission, reported Ardery, was completely automatic with the only pilot duties once in flight being those of instrument setting for altitude and speed constants, pushing the button that sets the bomb computer in action, and observing the radar screen at various check-points along the way to correct minor variations."

The all-weather navigation modes are doppler, contour mapping, ground mapping and terrain avoidance. The pilot's display is provided on a conventional c.r. tube and also (for all modes except mapping) by projection on to the windscreen.

A current development now being proposed by the company is for an all-weather reconnaissance package which would fit inside the fuselage bomb-bay of the 105. This would include side-looking radar, infra-red camera, low-level and high-level cameras, television viewfinder, air conditioner and radar altimeter.

Looking ahead after the Thunderchief, the company envisages four more possible generations of aircraft. The first is a VTOL attack aircraft, represented by the AP-100A, for which Republic have completed a design study. Using three GE lift fan engines, this machine would have a lifting fuselage and small cropped-delta wings. Span would be 35ft 6in and length 67ft 9½in.

More-advanced studies have covered a M4.25 bomber employing nuclear ramjets plus booster rockets for take-off; a M7 delta bomber powered by hydrogen-burning turbojets and ramjets; and a M25 vehicle, similarly powered, which would take off from an 8,000ft runway, accelerate to M5 on its turbojets and then switch to ramjets, and be capable of both orbital and sub-orbital missions.

The current expansion of the company's research and development activities was begun in 1958, when it was realized that a large investment was necessary if Republic was to make the change from aircraft to spacecraft and compete effectively for defence business in this new field. The decision was taken to go ahead with the construction of a $14m research centre in the belief that possession of such a facility would lead to firm R and D contracts.

The new centre, comprising seven specialized laboratories, is now approaching completion at Farmingdale. Perhaps the most obviously impressive piece of equipment there is the 30ft × 14ft diameter high-altitude chamber located in the Space Environment and Life Sciences Laboratory. This chamber will be able to simulate the near-vacuum corresponding to an altitude of 150 miles, and could be used to test space suits and capsules; missiles, satellites and their components; and the physiological and psychological reactions of man in the space environment.

In the same laboratory there is a small vacuum chamber, for testing equipment components and material specimens, which can be moved into a radiation room where an X-ray unit can be used to simulate part of the solar radiation spectrum.

The Re-entry Simulation Laboratory includes among its equipment a 24in, 100,000lb/sq in shock tunnel, a one-megawatt plasma jet with 27,000°F

This anechoic chamber forms part of the electronics laboratory in Republic's new research and development centre, and is used for the study of antenna performance in advanced aircraft and spacecraft

Prototype of the RCA tracking radar to be installed at the British BMEWS site, this unit is 84ft in diameter and is being tested at Moorestown, New Jersey

Radar and Research . . .

potential, a fast capacitor bank of 300,000 joules and a small shock tunnel for training. In addition, a 36in pebble-heated hypersonic blowdown tunnel has been designed for eventual installation alongside the existing Wind Tunnel Laboratory.

The development and evaluation of materials, processes and design applications to solve structural problems in high-speed aircraft, missiles and space vehicles is the task of Republic's Materials Development Laboratory. Also included is a Nuclear Radiation Laboratory, designed primarily to investigate radiation effects on space-vehicle and aircraft components and systems.

The function of the Electronics Laboratory is to study problems associated with VTOL blind landing systems, interspace communication systems and advanced instrumentation techniques.

The two remaining laboratories are respectively concerned with guidance and control, and fluid systems.

* * *

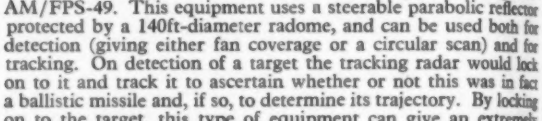
The prime system contractor to the US Air Force for the Ballistic Missile Early Warning System is Radio Corporation of America, and it was at this company's Missile and Surface Radar Division at Moorestown, New Jersey, that company engineers outlined for us the overall planning of the BMEWS system, and in particular the progress being made towards the installation of the third BMEWS site, to be located at Fylingdales Moor, Yorkshire. Overall direction of the BMEWS project is by the Electronics Systems Center of Air Materiel Command, and Western Electric Co has an associate prime contract for the communications network linking the three BMEWS sites with North American Air Defense Command at Colorado Springs.

It was originally thought that one site, at Thule, Greenland, would suffice, but it soon became obvious that additional flanking sites would be needed. Clear (Alaska) and Fylingdales Moor were chosen. The complete system was to include a communications link between NORAD headquarters at Colorado Springs and Strategic Air Command headquarters at Omaha; and a link from the British station to the Royal Air Force central display and warning facility.

Two main types of radar equipment are used in the BMEWS system. One is the General Electric AM/FPS-50 detection radar, employing a fixed antenna 400ft wide and 165ft high and generating two fans (wide in azimuth and narrow in elevation angle) of RF energy. The position and velocity of a missile would be determined as it passed through the lower and then the higher fan; its trajectory would be calculated from the two sets of co-ordinates; and the impact area and time would be predicted and the point of launch determined. This data would be processed at the site and transmitted to NORAD headquarters.

The second type of radar is the RCA tracking radar, designated AM/FPS-49. This equipment uses a steerable parabolic reflector protected by a 140ft-diameter radome, and can be used both for detection (giving either fan coverage or a circular scan) and for tracking. On detection of a target the tracking radar would lock on to it and track it to ascertain whether or not this was in fact a ballistic missile and, if so, to determine its trajectory. By locking on to the target, this type of equipment can give an extremely precise measurement of trajectory.

At Site 1 at Thule, four detection radars have been installed and these came into operation on October 1. The site also has provision for three of the RCA tracking-type radars, but budget authorization for these has not yet been received. Site 2 at Clear will have three detection radars, plus provision for two tracking units, and should come into operation next summer. The third site at Fylingdales will be the only one initially to use the AM/FPS-49 equipment. Three of these tracking-type radars will be employed, two of which will operate as detection radars and one as a tracker (and as a detection back-up).



An indication of warning times possible using the BMEWS site at Thule, Greenland. Thule is approximately midway between Moscow and New York

At each site data will be processed by a pair of solid-state computers mounted "back-to-back." This duplication enables either computer to take over from the other during a scheduled or unscheduled shutdown, and is designed to ensure continuous operation. The computers have a four-fold function:—

(1) Compute target trajectories from digitized target information.

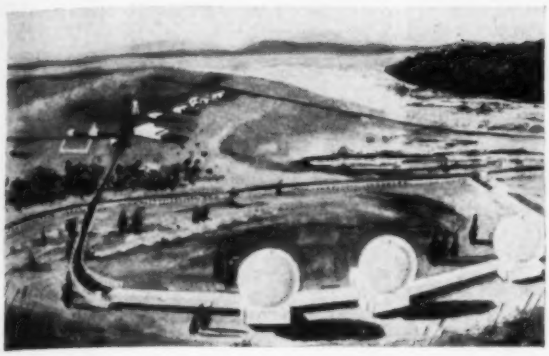
(2) Compare the trajectories with (a) observed satellites, (b) characteristics of auroræ and (c) the characteristics of meteor trails, to prevent a false alarm.

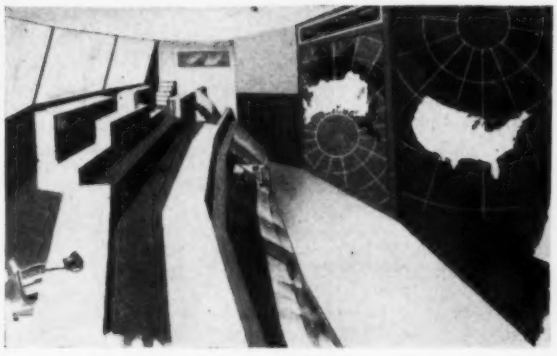
(3) Make crucial decision in selecting tracking radars to cover specified targets in the case of a mass raid.

(4) Formulate messages giving target data and appropriate level of confidence for transmission to the ZI (Zone of the Interior) display at Colorado Springs.

An important contribution to the reliability of the system is its automatic checkout and monitoring system. Important sections of

The radar dish shown at the top of this page is housed in this 140ft diameter radome at Moorestown. Radome, antenna and pedestal are built for RCA by Goodyear Aircraft Corp





Left, first illustration of the appearance of the BMEWS site at Fylingdales Moor, Yorkshire. Three tracking radars will be used, two of which will operate as detection radars and one as a detection back-up tracker. The domestic site is separate from the radomes, which are to be coloured light blue. Right, artist's impression of the combat operations centre of North American Air Defense Command at Colorado Springs, where BMEWS information is displayed. Launch-site position estimates would be shown on the left-hand chart, and predicted targets on the right

the radar subsystems are monitored continuously to verify their correct operation. Using punched cards and magnetic tape on which targets are simulated, any part of the system—or the entire system—can be checked out automatically, either from Colorado Springs or from the forward site concerned.

At the NORAD Combat Operations Center, Colorado Springs, data from the forward sites are decoded, evaluated, modified if necessary by other intelligence, and displayed (see diagram at head of page). A Display Information Processor assesses the "threat level" and the degree of confidence in the incoming information. The final decision as to whether this information represents an actual attack is then made by the NORAD commander, Gen L. S. Kuter.

At the RCA plant at Moorestown a full-scale prototype of the tracking radar is currently under test. Another prototype is undergoing mechanical life testing at the Goodyear Aircraft hangar in Acron, Ohio. The latter unit has been scanning continuously for over seven months without any failure. This type of equipment is in fact designed to operate continuously for ten years without major overhaul.

In the installation of the RCA equipment at the Fylingdales site, RCA Great Britain Ltd is providing support services to the prime contractor. Technical training courses are under way at the British company's factory at Sunbury-on-Thames, and a number of the firm's employees are now training at Moorestown.

The overall BMEWS philosophy, we were told at Moorestown, was to detect any mass raid and to protect the bases from which retaliatory forces would strike back—and not to protect any particular country. This meant that the philosophy was based on deterence and on alliance, with warning time for individual countries (such as the minimum of four minutes for the United Kingdom) provided as an additional bonus.

The flexibility with which the RCA radars could be operated was emphasized—although at Fylingdales the normal procedure would involve two as detectors and one as a scanner, it was possible to employ all three on either function as required. On the subject of co-ordinated RAF and NORAD planning, a joint operational doctrine was now being written. Fylingdales would be under RAF command, with a combined team of USAF and RAF officers on the base to ensure that the joint doctrine was carried out.

Because of the extremely high intensity of the radar beams, a safety committee had established safety zones and radiation levels as the basis of a set of rules for site personnel. Margins allowed were conservative, and at Fylingdales the fenced distance in front of the radars would be 7,000ft. The three main building sites at the Yorkshire site were now being prepared, a main access road was being constructed and foundations were being worked on.

To be told about the radar equipment was one thing: to climb inside the huge white radome of the Moorestown tracker and see for ourselves was quite another. Above us towered the 84ft diameter parabolic reflector dish, scanning from side to side (but not transmitting, for obvious reasons) in an awesome combination of sheer mass and smooth motion. The reflector comprised a complex steel frame on which was stretched a wire mesh; four beams converged to carry the feed horn unit at the focus of the parabola. One of the less-technical members of the party summed it up as "strict mad-scientist stuff."

A fantastic impression of size and space was given by the pale radome sphere inside which we were standing, the honeycomb pattern of its constituent panels standing out in outline as pinhole dots of light. The sphere is made up of twelve large sections, each section comprising a large number of hexagonal and pentagonal panels. The total number of panels in the radome is 1,646, and they are constructed of a glass-fibre/paper honeycomb/glass-fibre sandwich and bolted together. The external white paint is transparent to radio waves, and we were given an advance decoration tip on Fylingdales—Britain has chosen light blue for her radomes.

Inside the 38ft high base building (built on separate foundations from those carrying the tower on which the radar pedestal and dish are mounted) we visited the missile impact computer system which processes the data acquired by the radar. This represents in function but not in exact type of equipment the computer installation planned for Fylingdales. On one printer unit the following columns were being typed out: time, azimuth, elevation, range, and co-ordinates x, y and z.

A little later along the line, we realized, this sort of information would pass through the display information processor at NORAD headquarters in Colorado Springs and would be reflected in the line of columns in Gen Kuter's illuminated summary panel on the wall. On this display the titles were UK alarm level, raid estimate, predicted impacts, minutes to go (to first impact), and alarm level.

* * *

Moorestown was the final point of call on the official programme of our 3½-week visit, which had been sponsored by the US Defense Department, State Department and Information Agency. The unenviable job of escorting a mixed bag of 17 journalists through an extremely tight schedule had been handled competently by Maj Bob Spence of Third Air Force, South Ruislip, and Mr Richard France from Air Force Headquarters at the Pentagon. But our particular thanks went to Maj Paul Donohoe and Capt Allen Wetmore, commander and co-pilot of our Convair C-131, for their smooth flying over some 7,500 miles of the USA.

BMEWS Site 1 at Thule, Greenland, became operational on the first of this month. It has four fixed detection radars, three of which are shown here, and provision for additional tracking radars. The 400ft × 165ft reflectors formed part of General Electric's responsibility as subsystem subcontractor to RCA

Some of the satellites and space probes developed, or under development, at Goddard Space Flight Center. Details of these craft are given in the first news item below

Missiles and Spacecraft

SPACECRAFT GALORE

Recently released by the US National Aeronautics and Space Administration are the two illustrations above, showing some of the varied satellites and probes developed or under development at Goddard Space Flight Center, Greenbelt, Maryland. The left-hand group includes the first illustration of the first joint Anglo-American satellite to be launched by Scout next year. Although this gives a reasonable general picture of the joint satellite, it is not exactly correct—one major difference is the addition of four "paddlewheel" sections carrying solar cells. (First picture, p. 631.)

Satellites and probes are identified in the illustrations by the respective prefixes S and P. Those in the left-hand diagram are: S-30, ionosphere direct measurements (Explorer series, Juno 2); Pioneer 5, in solar orbit; Explorer 6, in Earth orbit; P-31, lunar orbiter (Atlas-Able 5); Echo 1, in orbit; S-51, international ionosphere (joint US-UK programme, Scout); S-16, orbiting solar observatory (Delta); P-21, electron density profile (Scout); P-26, nuclear emulsion recovery vehicle (Scout); Tiros 1, in orbit; S-3, energetic particles (Delta); S-6, atmospheric structure (Delta); P-14, interplanetary probe (Thor-Delta); and Vanguard 3, in orbit.

In the right-hand picture the spacecraft are as follows: S-15, gamma-ray astronomy (Explorer series, Juno 2); Explorer 7, in orbit; S-45, ionospheric beacon (Explorer series, Juno 2); S-48, fixed-frequency topside ionosphere sounder (Scout); and S-27, sweep-frequency topside ionosphere sounder (joint Canadian-US, Thor-Agena B).

GO-AHEAD FOR SPACE OBSERVATORY

Grumman Aircraft Engineering Corporation has been selected by the US National Aeronautics and Space Administration for negotiation on a $23m contract to develop an orbiting astronomical observatory. Telescopes aboard the OAO will study cosmic phenomena—X-rays, ultraviolet and infrared rays—obscured from ground observatories by the Earth's atmosphere.

Grumman has proposed an octagonal satellite, 9½ft high and 6½ft in diameter, weighing some 3,200lb (including 1,000lb of experimental equipment). The spacecraft will be a standardized shell containing stabilization, power and telemetry instruments into which one or more separate experiments can be fitted for each flight. Astronomical equipment with reflecting mirrors up to 36in in diameter will be mounted in a cylindrical chamber running through its length.

Two flight-model spacecraft will be built under this contract, the first to be delivered in 2½ years' time. NASA plans to launch the first OAO in late 1963 from Cape Canaveral into a 500-mile circular orbit, using an Atlas-Agena B vehicle.

FIRST SAMOS FAILS

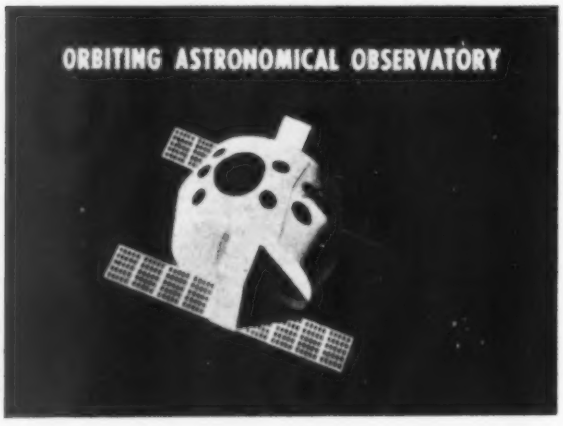
The first test satellite in the USAF Samos reconnaissance-satellite programme failed to achieve orbit on October 11 after launch by Atlas-Agena from Point Arguello, California, down the Pacific Missile Range. It was reported that the second-stage Agena rocket motor failed to ignite.

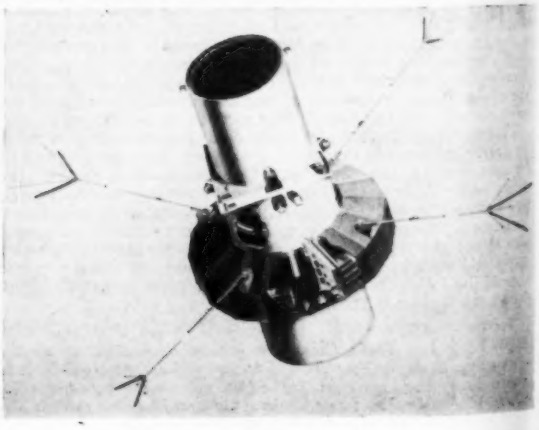
The importance of the Samos project, in view of its significance in providing a spaceborne successor to the U-2 aircraft, is indicated by the fact that the programme has been moved outside the normal USAF satellite organizational framework and now comes directly under the Secretary of the Air Force at the Pentagon. As the programme is in many respects a follow-on from the Discoverer series, it seems probable that the method employed to obtain photographs taken from the satellite will be by recovery of a data capsule after re-entry following a specified number of orbits, and not by radio transmission of the pictures in mid-orbit.

SCOUT DETAILS

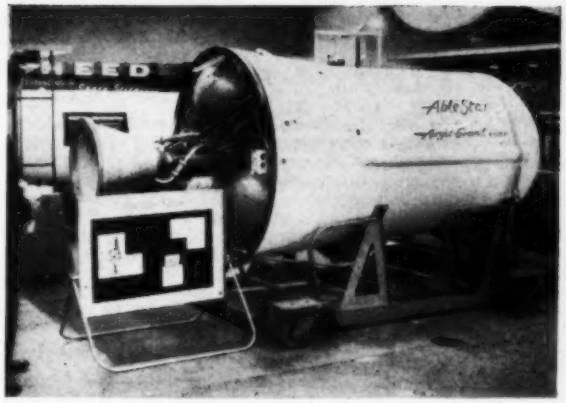
Three radio telemetry systems in the Scout rocket vehicle launched on October 4 were used to measure and transmit data on flight environment and performance of the four rocket motors and guidance system. In the first stage, one unit transmitted 22 measurements of fin positions, temperatures, pressures and

The go-ahead for the development of an orbiting astronomical observatory has now been given by the National Aeronautics and Space Administration (see news item above). Below left is a NASA impression of the possible appearance of such an observatory; on the right is another version which has been proposed by Hughes Aircraft. The Grumman proposal now being negotiated may well prove similar





Propulsion by Aerojet-General and guidance by Space Technology Laboratories are features of the AbleStar second stage of the Thor-AbleStar vehicle. AbleStar is 14ft 10in long and 4ft 7in in diameter, and has a total burning time of some 300sec, of which 285sec would typically be used for initial orbital injection. Fuel and oxidiser are inhibited red fuming nitric acid and UDMH



accelerations during the first 60sec of the flight of the vehicle.

A second telemetry system at the top of the third stage monitored the performance of the vehicle from firing until the coast period of the third stage. Some 70 measurements of vibrations, temperatures, guidance-control signals, pressures and events gave detailed information on the environment and systems performance.

Located in the fourth-stage payload, the third telemetry system performed a dual function. During burning of the four motors, this measured payload environment, vehicle accelerations and fourth-stage roll rate. After fourth-stage burnout it was used throughout the flight to obtain scientific measurements.

The four solid-propellant rocket motors used in Scout are:—

(1) Algol, 30ft long × 40ft diameter, developing 115,000lb thrust, fin-stabilized and controlled by jet vanes (Aerojet-General Division of General Tire & Rubber Co).

(2) Castor, 20ft × 30in diameter, over 50,000lb thrust, a modified version of Sergeant, stabilized and controlled by hydrogen peroxide jets (Redstone Division of Thiokol Chemical Corp).

(3) Antares, 10ft × 30in diameter, over 13,600lb thrust, scaled-up version of fourth stage, stabilized and controlled by hydrogen peroxide jets (Allegany Ballistics Laboratory, a Navy Bureau of Weapons facility operated by Hercules Powder Co).

(4) Altair, 6ft × 18in diameter, 3,000lb thrust, formerly known as X-248 developed for Vanguard third stage, spin-stabilized (Allegany Ballistics Laboratory).

Vought Astronautics Division of Chance Vought Aircraft are prime contractors for launch-tower fabrication and installation, and manufacture of airframe and motor transition sections. Guidance and controls are by the Aeronautical Division of Minneapolis Regulator Co.

FUNDING POLARIS

Owing to their demonstrated practicability, the Polaris and the FBM submarines are being accelerated still further over the original FY61 schedule. From the block of funds provided by Congress to accelerate chosen programmes, the Department of Defense has taken $107.6m for this purpose. Of this total, the major part—$70.6m—is allocated to hastening the development of the 2,500-mile Polaris A3, which will enormously improve the payload/range of the existing FBM ships, and will bring almost every point on the Earth's surface within their reach. The other $37m will buy current A-1 missiles for new submarines. In this context it is worth noting that all four of the enlarged (6,900 tons surface displacement) *Ethan Allen* class will be launched before the end of 1961, the first of this class taking to the water on November 22. A fifth 6,900-tonner is about to be started, together with four of the still larger *Lafayette* class.

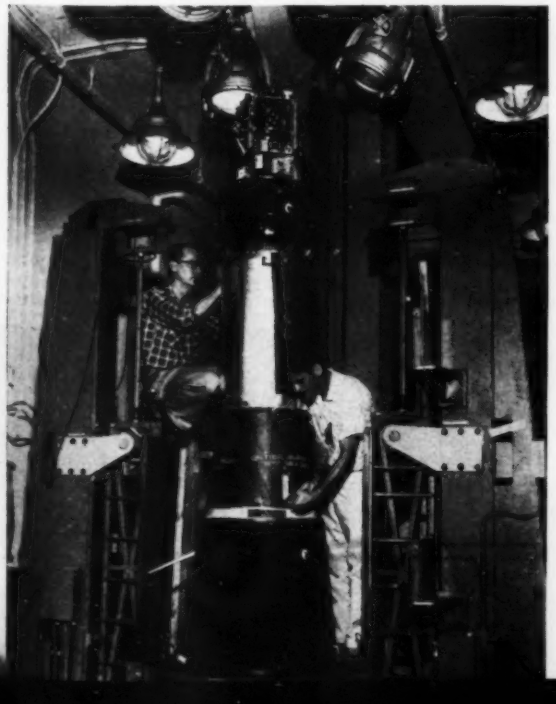
GERMANS CONSIDER SEACAT

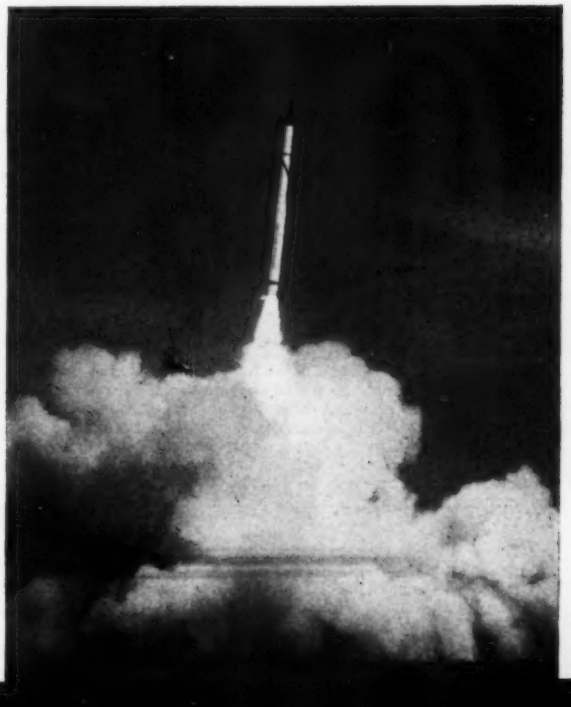
For more than a year the West German Defence Ministry has had under review the Seacat ship-to-air weapon as possible armament for units of the Federal German Navy. At present the latter service is forbidden by treaty from building warships of more than 3,000 tons, but strong representations have been made to the West European Union to raise the limit to at least 6,000 tons. This would enable a class of guided-missile ships to be laid down armed with Seaslug (or an American weapon, such as Advanced Terrier) and Seacat, together with their associated magazines, handling systems and fire-control. An unofficial report from Bonn claims that "the German order for Seacat is to be placed shortly."

LAUNCH IN LAPLAND

It was announced in Stockholm on October 6 that during the previous week the new guided-weapons range in Arctic Sweden became operational. On that date what is described as "the first Swedish-designed military missile, probably of ground-to-air type" was launched down the range in an experimental mission described as "rather satisfactory." The range is roughly 43 miles long and 18 miles wide and includes an airfield; although the terrain is exceedingly barren, the report states that, before the missile was fired, ten local residents had to be evacuated by helicopter. The only Swedish guided weapons of which details have been published are cruise-type bombardment weapons for launching from ships and aircraft, and a small anti-tank missile by Bofors; for surface-to-air purposes the Royal Swedish Air Board has placed an order for an evaluation quantity of Bristol/Ferranti Bloodhound Mk 1s.

The successful firing of a four-stage solid-propellant Scout rocket from Wallops Island on October 4 (below right) was reported briefly in last week's issue. The four stages comprise an Aerojet-General Algol, Thiokol Castor (modified Sergeant), Allegany Ballistics Laboratory Antares (scaled-up Altair), and ABL Altair (formerly known as X-248). Left, NASA technicians of Langley Research Center prepare the payload (see news item "Scout Details") for the October 4 launch





Aerodrome Owners Confer

AOA KENTISH COAST DISCUSSIONS AND VISITS

EACH year the Aerodrome Owners' Association (which includes owners of helicopter stations) meets in conference to discuss subjects of common interest and to visit local aerodromes, seeing how fellow-owners run their affairs. This year's venue was Folkestone, and a hundred-odd members and guests descended on the Kentish coast resort last week. A half-day was spent at the conference headquarters, the commodious Grand Hotel which looks out over the English Channel from the famous Leas, and the remaining day-and-a-half on local visits. These were both waterborne (a tour of Dover docks) and airborne (a flight to Le Touquet and back), emphasis being on the passenger and freight services this part of Kent provides to the Continent—from Dover Harbour and from Lympne and Lydd (Ferryfield) airfields.

It was a concentrated morning session on October 11, with the Ministry of Aviation, Customs, aircraft fire-fighting and helicopter transport as subjects on the agenda. AVM Sir Laurence Sinclair, who left the RAF three months ago to become Controller of Ground Services at the MoA, confessed that he was new to the job but emphasized his willingness to do all he could to help aerodrome owners. Without making any specific statement of Ministry policy towards non-State airfields he displayed a friendly presence and told the delegates that if any of them had any particular suggestions he would like to hear them. He received one from Mr C. M. Newton of Sywell, who described the air vice-marshal as "the largest owner of airfields in the country": this was that the MoA should hand over more of its airfields to the municipalities and use some of the money thus saved on ground services. AVM Sinclair told his audience that the Ministry was carrying out a most intensive study of air traffic control problems, and gave the conference an encouraging text for its deliberations when he said: "I really believe civil aviation is on the flood tide; it has at last made an impact on the British public: mass air travel is now a reality."

Some concrete examples of current practice in mass air travel were seen by the delegates when they went out to visit Lympne and Ferryfield. At the former they were welcomed by the managing director of Skyways Ltd, Mr Eric Rylands, whose staff has so effectively built up coach-air services to the Continent from this famous old airfield. Lympne did not present the busy scene which obtains in the summer season, but the delegates had ample opportunity of examining its facilities for aircraft and passenger handling and of admiring the trim and pleasing way in which its amenities are maintained. At the airfield there was a demonstration of fire-fighting by means of dry chemicals put on by John Kerr and Co (Manchester) Ltd, the Liverpool fire equipment company. At the previous day's lecture session the firm's managing director, Mr H. G. Clements, had presented a forceful exposition of the merits of dry chemicals in fire fighting, emphasizing that risk of explosions was limited by the use of a dry powder. Certainly the demonstrations at Lympne were impressive, quickly subduing burning petrol and contaminated alcohol set up in different forms, both static and sprayed.

Gallic Hospitality

At Ferryfield, likewise, the airfield was not nearly so busy as during the summer season; but delegates were able to see and have explained to them the way in which Silver City take cars and passengers across the Channel—at the rate, in July this year, of over 600 cars and more than 2,000 passengers in a single day. They had a look round some of the Bristol Freighters in both passenger- and car-carrying configurations, and were shown the paper work procedure in getting passengers and vehicles documented. The aerodrome owners were welcomed to Ferryfield by the airport and operations manager of Silver City Airways Ltd, Mr D. Kinnear; and after a buffet luncheon, 34 of them went off in the Silver City Dakota *City of Cambridge* to Le Touquet, for a 45-minute taste of Gallic hospitality.

It was during the indoor conference sessions at the Grand Hotel that the two most detailed papers were presented, by Mr R. W. Radford of HM Board of Customs and Excise, and Mr Raoul Hafner, special director of Westland Aircraft Ltd. Mr. Radford said that the title of his talk—*Customs Facilities at Non-State Aerodromes*—had been chosen for him; and his theme was that though Customs wanted to do all they could to help aerodrome owners, there were practical difficulties in finding staff to supply facilities to airfields which did not yet possess them. He said that a large proportion of Customs personnel in local offices now dealt with purchase tax, which limited the availability of staff. The yardstick for providing Customs facilities was a thousand movements a year, though he did concede that airfields with less might be granted Customs. This year two more airfields had been given facilities, and the Board was prepared to consider more applications. On the other hand, they might withdraw facilities from airports where traffic declined. He admitted quite frankly that relations between the AOA and his board hadn't always been as happy as they might have been; there had been too little contact between the Customs and the aerodrome owners: but he personally was a strong believer in "getting to know the other chap." Mr Radford expressed his main theme as: we in Customs have a public duty to do, and want to do it as pleasantly as possible.

He was taken up particularly on one point by Mr B. Collins of Southend, who asked about private aircraft owners, and whether the law was the same for them as for the owners of private yachts when outbound. This drew from Mr Radford the answer that the policy in general was not to discriminate against air as opposed to sea. He said that the board would be looking at the position of private aircraft owners in the coming months. When Mr R. Birkett of Skyways asked whether in handling large numbers of passengers they would be willing to take a sample case and let the rest go through, to save time, Mr Radford said that though the experienced Customs man can distinguish "those who have got watches round their middles" he didn't think letting nine-tenths of the passengers go unexamined would solve the problems of delay.

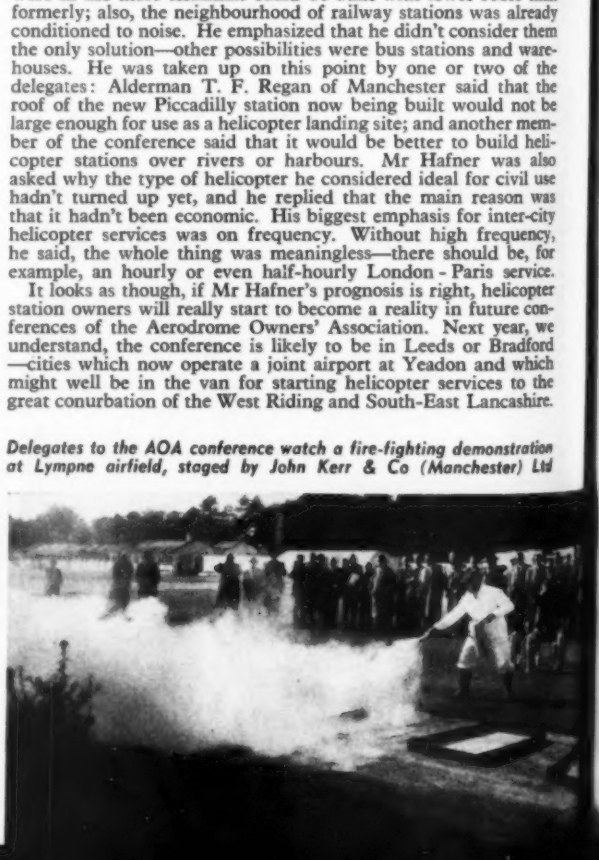
Regular Helicopter Services

When Mr Hafner spoke about *The Case for Helicopter Transport in the UK* he gave delegates the benefit of a lecture, with some variations, he had given at the Les Journees de Giraviation symposium in Paris recently (*Flight* last week). This pictured for the conference regular inter-city helicopter services performed by twin-rotor four-engined machines landing at stations with two 300 by 100ft strips. These helicopters would comply with minimum requirements for vibration and noise level, would have a 30-40,000lb all-up weight and carry about 40 passengers and be economic in operation at about 3d a mile. Mr Hafner stressed particularly that transport policy for helicopters must be to have smaller machines operating more frequently rather than larger ones less frequently. He went into all the reasons why he preferred a tandem-rotor configuration, compounded with a fixed-wing and with propelling power augmented by four jets, as his formula for the ideal transport helicopter.

As to the siting of heliports, he suggested that the best place was above railway stations. Now that diesel and electric power units were in use these terminals could be built with lower roofs than formerly; also, the neighbourhood of railway stations was already conditioned to noise. He emphasized that he didn't consider them the only solution—other possibilities were bus stations and warehouses. He was taken up on this point by one or two of the delegates: Alderman T. F. Regan of Manchester said that the roof of the new Piccadilly station now being built would not be large enough for use as a helicopter landing site; and another member of the conference said that it would be better to build helicopter stations over rivers or harbours. Mr Hafner was also asked why the type of helicopter he considered ideal for civil use hadn't turned up yet, and he replied that the main reason was that it hadn't been economic. His biggest emphasis for inter-city helicopter services was on frequency. Without high frequency, he said, the whole thing was meaningless—there should be, for example, an hourly or even half-hourly London - Paris service.

It looks as though, if Mr Hafner's prognosis is right, helicopter station owners will really start to become a reality in future conferences of the Aerodrome Owners' Association. Next year, we understand, the conference is likely to be in Leeds or Bradford—cities which now operate a joint airport at Yeadon and which might well be in the van for starting helicopter services to the great conurbation of the West Riding and South-East Lancashire.

Delegates to the AOA conference watch a fire-fighting demonstration at Lympne airfield, staged by John Kerr & Co (Manchester) Ltd



Prospects for the Airline Helicopter

RELATIVE OPERATING COSTS ANALYSED

By D. T. GRANT, BSc, AFRAeS

WHILE the helicopter has established itself as a practical VTOL vehicle in military operations and its range of applications is increasing in certain commercial fields in which the ability to hover is a primary consideration, its use in scheduled passenger transport operations has been abortive in many cases and only maintained in others with the help of a financial subsidy. Since these scheduled operations have been running now for some five years it is pertinent to enquire whether the experience gained augers well or ill for the civil transport rotorcraft now in the prototype stage.

The helicopters currently being used on scheduled passenger operations are single piston engine machines which were initially designed for military operations. Their L/D ratios, disposable loads and cruising speeds are considerably less than the corresponding values for comparable fixed-wing aircraft. This, together with the low overhaul lives and complicated maintenance procedures associated with their rotors and transmission, has resulted in high operating costs.

However, any facility which gives an aircraft another mode of operation, such as the ability to take-off and land vertically, may be expected to increase direct operating costs. Whether VTOL capability would lead to a reduction in indirect operating costs is not as clear cut.

The ability to take off and land from a restricted area enables the helicopter to operate nearer to the centres of population and creates advantages in journey time and convenience over the fixed-wing aircraft on short ranges. It also enables air travel to show a distinct advantage over surface transport on ultra-short ranges. From a commercial point of view, therefore, it is necessary to determine whether the advantages of the helicopter can create a revenue sufficiently high to obtain a ratio of revenue to operating cost as good as that achieved by other forms of air travel.

In Europe, Sabena have been operating scheduled helicopter passenger services since 1955 and in 1958 carried over 50,000 passengers over an unduplicated route-mileage of 652. No detailed traffic or financial statistics are available on these operations, but A. V. J. Vernieuwe, the airline's operations manager, has stated that the revenue obtained has not been sufficient to defray the cost. The service has been continued, however, because Sabena contend that it enables them to gain experience in a form of air travel which is essential if the airlines are to make any substantial inroads into inter-city travel in densely populated Europe.

Sabena's approach appears to be to charge the same fare per passenger-mile as that pertaining for fixed-wing aircraft over the corresponding stage-length. In particular, the journey time from Brussels to Paris by helicopter is 115min, that is from Issy-les-Moulineaux in Paris to the Allee Verte in Brussels. By fixed-wing aircraft—Sabena's Convair 340 service—the journey time is 215min including the coach time at Paris and Brussels; yet the tourist fare of $16.00 is the same for both services. The concept that the shorter journey-time and greater convenience of the helicopter could generate a high revenue per passenger-mile does not appear to have been followed by Sabena.

US Operators' Progress

On the other hand, the three US helicopter operators, Chicago Helicopter Airways, New York Airways and Los Angeles Airways, have a revenue per passenger-mile nearly five times greater than that obtained by America's local-service airlines. In 1959 these operators carried over 366,000 passengers, a yearly rate of growth since 1955 of nearly 90 per cent. Over the same period the government subsidy to the helicopter airlines dropped from $93.5 per passenger to $7.5 per passenger.

In 1959 the ratio of revenue per passenger-mile over total operating costs per seat-mile was 0.67 for all the helicopter services operated in the US, compared with 1.37 for the local-service airlines and 1.56 for the domestic trunk airlines. Assuming that the revenue per passenger-mile, the load-factor and the division of direct and indirect operating costs were the same as those achieved by the US helicopter operators in 1959, the average direct operating cost per passenger-mile of the helicopter would have to be reduced from 32 cents to 13 cents to obtain the same operating ratio of 1.56 achieved by the domestic trunk airlines, who had no public service revenue in 1959.

Civil transport helicopters on order by the US helicopter operators are the Sikorsky S-61 and the Vertol 107, scheduled for delivery in 1961. The direct operating cost of these helicopters lies between 8 and 10 cents per seat-mile. Their productivity, however (in terms of passenger-miles generated for a given annual utilization), is nearly four times greater than that of the present equipment, which would mean an increase in the number of passengers carried and/or an increase in the average stage-length.

Since the multi-engined safety and high block speeds of these helicopters are features invoking higher passenger appeal, they should create an increased demand; but it is probable that an increase in the average stage-length would have to be accompanied by a decrease in the revenue per passenger-mile.

The average stage-length per passenger of the US helicopter operators in 1959 was 22 miles, making an average fare of $6.8; this is comparable with taxi distances and fares to and from airports, though the helicopter gives a substantial saving in time. A significant increase in stage-length would take the helicopter out of this market in terms of distance and fare at the current revenue per passenger mile.

With a direct operating cost of 10 cents per seat-mile, and assuming the same ratio of indirect to direct operating costs as that currently achieved, the revenue per passenger-mile could be reduced from 31 cents to 22 cents to achieve a 56 per cent return on total operating costs at the current load-factor. At the same average fare of $6.8 this would increase the stage-length to 31 miles. On such an increase in average stage-length, with a fourfold increase in productivity, the number of passengers carried would have to be increased by 270 per cent; at the current rate of growth this would be achieved in two years.

This analysis indicates that, while the Vertol 107 and Sikorsky S-61 have the potential to enable the US helicopter airlines to break free of financial subsidy and achieve a return on total operating costs as good as, if not better than, that achieved by the domestic trunk airlines in the market and at the revenue rates they are currently operating, these helicopters have not low enough operating costs to effect a substantial encroachment beyond this market.

The average stage-length of the local-service airlines in 1959 was 198 miles and the revenue per passenger-mile 7.2 cents. Large rotorcraft at present in the project stage have direct operating costs of 4 cents per seat-mile. At this level of operating costs the helicopter could break into the local-service market and obtain a return as good as that achieved by the domestic trunk airlines in 1959 at a revenue rate some 30 per cent greater than that achieved by the local services. The journey time (assuming a fixed-wing cruising speed twice that of the helicopter and that the latter operates from city centre to city centre) would be 40 per cent less by helicopter.

The experience of the US helicopter airlines would indicate that passenger demand is non-elastic up to revenue rates in terms of cents per passenger mile, some five times greater than that of US fixed-wing airlines; and that, within the route pattern operated by these helicopter airlines, a return on operating costs fully comparable with that achieved by the best of the fixed-wing operators is possible with the new turbine-powered transport helicopter scheduled for delivery in 1961. The possibility of the helicopter operators extending their route network beyond their present range and into that of the local-service airlines appears possible at the direct operating costs claimed for large rotorcraft now in the project stage.

Sport and Business

Fuel pods and a quartet of rear-mounted engines (P & W JT-12s) bestow an aggressively military look in this recent picture of Lockheed's JetStar executive, five of which are beginning flight-testing at the company's Marietta plant

THE AIRCRAFT OWNERS and Pilots Association of Australia now has 1,600 members and is affiliated with the American AOPA and the corresponding organizations in Canada and South Africa. At the annual AOPA conference in Melbourne on September 30, the Secretary, Capt Tom Young, said that a sudden expansion was occurring in the introduction of new light aircraft into Australia. About 160 new light aircraft had been registered in the first nine months of 1960, and it was anticipated that the total annual increase in the register would be 300 a year as from 1963.

The conference decided to press the Department of Civil Aviation for a reintroduction of the right for private pilots to fly at night under VFR when weather conditions permitted. This had been allowed in Australia until six years ago, and it is still permitted in the USA. It was also decided to ask DCA to consider a third-class instrument rating for private pilots, which would allow them to operate under IFR conditions when cloud bases were high enough to permit fairly normal landings. Delegates believed such developments would greatly assist the expansion of the light-aircraft movement in Australia.

A considerable debate arose when a Tasmanian delegate spoke on the matter of insurance of aircraft owned by pastoralists who used them to inspect and control large properties. Many of these "stations" were valued at £100,000 and up because of inflated land prices but, in the primary industry, one was lucky to secure a one-per-cent return on this purely fictitious value. Valuers for probate had to accept the market or sale value of the land, nevertheless, and this meant very great hardship. These pastoralists were coping by taking out large insurance policies to cover probate, but they were finding many life-insurance firms were charging extra for pilots using their own aircraft. A prominent insurance company executive addressed the conference without attracting any enthusiastic response from his audience.

What the conference wants, in the words of an Australian correspondent, is that insurance companies should stop ranking private pilots and owners as freaks and regard them in the same light as car drivers and owners.

AUKLAND AERO CLUB has placed orders with the aircraft division of Victa Consolidated Industries, Sydney, for six Victa Air Tourers (formerly known as the Millicer Air Tourer, this type was designed by Mr H. Millicer, now chief designer for Victa) and a number of four-seat Victa R-2s. Deliveries are to begin next March. The orders were placed by Mr I. C. MacCormick, secretary-manager of the club, and Mr A. G. Heath, a committee member, who represented New Zealand at the Australian AOPA meeting reported above.

BRILLIANT SUNSHINE brought a crowd of between 15,000 and 20,000 people to Weston Airfield, County Kildare, last month for the International Parachuting Rally organized by the Irish Parachute Club. Thirteen parachutists—three from Ireland, two from Australia, one from New Zealand and seven from the United Kingdom—made a total of 22 descents from various heights below 10,000ft. Ireland's only qualified woman parachutist, Bernadette Gormley, opened the programme with a ten-second free fall from 4,000ft—her eleventh descent. The spot-landing competition was won jointly by Norman Hoffman of the Sky-Divers and Bill Sparke of the Victoria Parachute Club in Australia, with Charles Stewart, also of the Melbourne club, as runner-up. Mike Reilly, chairman of the Royal Aero Club Parachuting Committee, and Norman Hoffman provided the finale to the display by dropping simultaneously from separate aircraft and endeavouring, unsuccessfully, to exchange a baton whilst in free fall prior to pulling their ripcords.

RETROSPECT

From "Flight" of October 22, 1910

A Record which was Not! It is a pity some of our French confrères do not glance occasionally at the list of official records on the last page of FLIGHT, as it might have prevented an unnecessary waste of flowery language over the so-called "world's record" made by Leblanc at St. Louis on Saturday. Using the 100 h.p. Gnome-engined Blériot, built for the Gordon-Bennett Cup, he covered a mile in 53secs, representing a speed of 67.92 miles, or 109.3 kiloms, per hour. This has been hailed by the French as a "world's record," calmly ignoring the fact that at Lanark J. Radley did the mile in 47 secs at a speed of 75.95 m.p.h., which, after all, is just a little better than the *stupéfiante performance de Leblanc.*

AVIAN INDUSTRIES of Georgetown, Ontario, hope shortly to resume the test programme on the Avian 2/180 which was interrupted with the loss of the first aircraft on April 8. It was reported recently that the Avian "took off inadvertently during taxying tests" at Waterloo-Wellington Airport, Kitchener, Ontario. The gyroplane, it will be recalled, is a 2/3-seater autogiro, propulsion of which is by a ducted fan driven by a 180 h.p. Lycoming engine. Initial cost is claimed to be less than one-third of a conventional helicopter and operating cost per aircraft mile, based on an annual utilization of 500hr, only six cents. Normal cruising speed is 130 m.p.h., still-air range 480 miles, and ceiling 17,000ft.

COMING INTO OPERATION this month is a VOR beacon near London Airport. Its radial bearings should be very useful to private pilots finding their way around the London control zone. The exact location is at 512740N 002802W and the identification is MWZ. The beacon transmits on 116.0 Mc/s.

THE FIRST FATAL ACCIDENT for ten years occurred at the London Gliding Club, Dunstable, on September 30. Following a winch launch to 1,000ft an instructor and pupil in a Slingsby T-21B were killed after the glider entered a shallow dive from which it failed to recover. The instructor was Mr John Westhorpe and the pupil Peter Carter.

THE SOUTH AFRICAN PIPER AGENTS, Placo Aircraft Sales of Wanderboom Airport, Pretoria, are supplying two Piper Aztecs to the Northern Rhodesia Government. This brings the administration's fleet to two Aztecs, one Apache and one Tri-Pacer.

Godfrey Harwood brings the Crown Agents Swallow in to a landing at Dunstable during the recent national glider aerobatic contest

New Tunnels for Warton

ADDITIONAL FACILITIES FOR ENGLISH ELECTRIC AVIATION

TEN years ago the British aircraft industry was producing advanced aircraft projects by the score, but large high-speed tunnels in which they could be tested were conspicuously absent. Today the position is markedly different: projects for new high-speed aircraft can be counted on the fingers of one hand, but in the matter of research facilities the industry has pulled up its socks in a determined manner. Every major British aircraft company now has the use of generally adequate transonic and supersonic tunnels, in most cases paid for by the firm concerned. These facilities, most of which are either driven by turbojets or are of the intermittent blow-down type, are backed up by tunnels of the more expensive continuous-running variety at the RAE Bedford (*Flight*, July 5, 1957) and Aircraft Research Association (*Flight*, May 4, 1956).

On October 19 the Minister of Aviation opened a new blow-down facility in Lancashire which in many respects can be regarded as the most capable in Europe. Located at Warton, the flight-test centre of English Electric Aviation (member of British Aircraft Corp), and financed entirely by the company, it consists of a 4ft tunnel for Mach numbers between 0.4 and 4 and an 18in tunnel for Mach numbers between 1.5 and 6, both served by the same air storage.

Final inspection of a delta-wing/body calibration model inside the 4ft tunnel, showing the slotted liner of the working section

English Electric's installations at Warton may well surpass in capability the wholly owned facilities of any other company in the world. The first tunnel was built there in 1948; it is a 9ft × 7ft continuous-runner, with a maximum speed of 170ft/sec and digitized output to facilitate immediate analysis by an English Electric Deuce (*Flight*, April 15, 1955). The following year the company installed a pioneer turbojet-powered tunnel, built as a high-subsonic installation with a working section 3ft 8in × 1ft but modified in 1950 to have a slotted 1ft-square working section for transonic operation. With this tunnel the company's staff perfected new instrumentation systems, and in particular methods of employing straingauges, model supports and balances at Mach numbers between 0.6 and 1.1. It also enabled Mr Petter's team to develop the Canberra.

Armed with the knowledge gained with it, the company installed a larger and more advanced tunnel in 1954 in order to support the test programme on the P.1 research aircraft (which later became the Lightning fighter). Powered by two Rolls-Royce Nene engines, this tunnel has an 18in slotted transonic working section which can be replaced by solid liners matched to Mach numbers of 1.4, 1.6 and 1.7. Again, the outputs are digitized. Yet another facility is an 18in water tunnel in which separated and vortex flows can be investigated visually at up to 20ft/sec.

By 1956 it was a *sine qua non* that the company's design staff, led by Mr F. W. Page, would have to reach out into realms beyond Mach 2. English Electric had not joined the Aircraft Research Association, and in any case it was clear that their interests were leading them into fields in which the ARA facilities, and even those at the RAE, would be inadequate. Not only was the company intensively investigating advanced military aircraft—largely of the "Canberra-replacement" variety (which have since evolved into the TSR.2 programme)—but they were also taking more than a passing look at supersonic transports and a variety of guided weapons. Newer, better-instrumented and faster tunnels were inescapable requirements, and in December 1956 the decision was taken to finance the construction of a wholly new facility, of the blow-down type, with two working sections, one chiefly for aircraft and one for missiles. It is possible now to outline the characteristics of the installation, which is described by the company as "meeting the requirements of the next generation of aircraft and winged missiles, and also covering re-entry conditions for certain ballistic missiles." Particularly outstanding is the new facility's data-handling system.

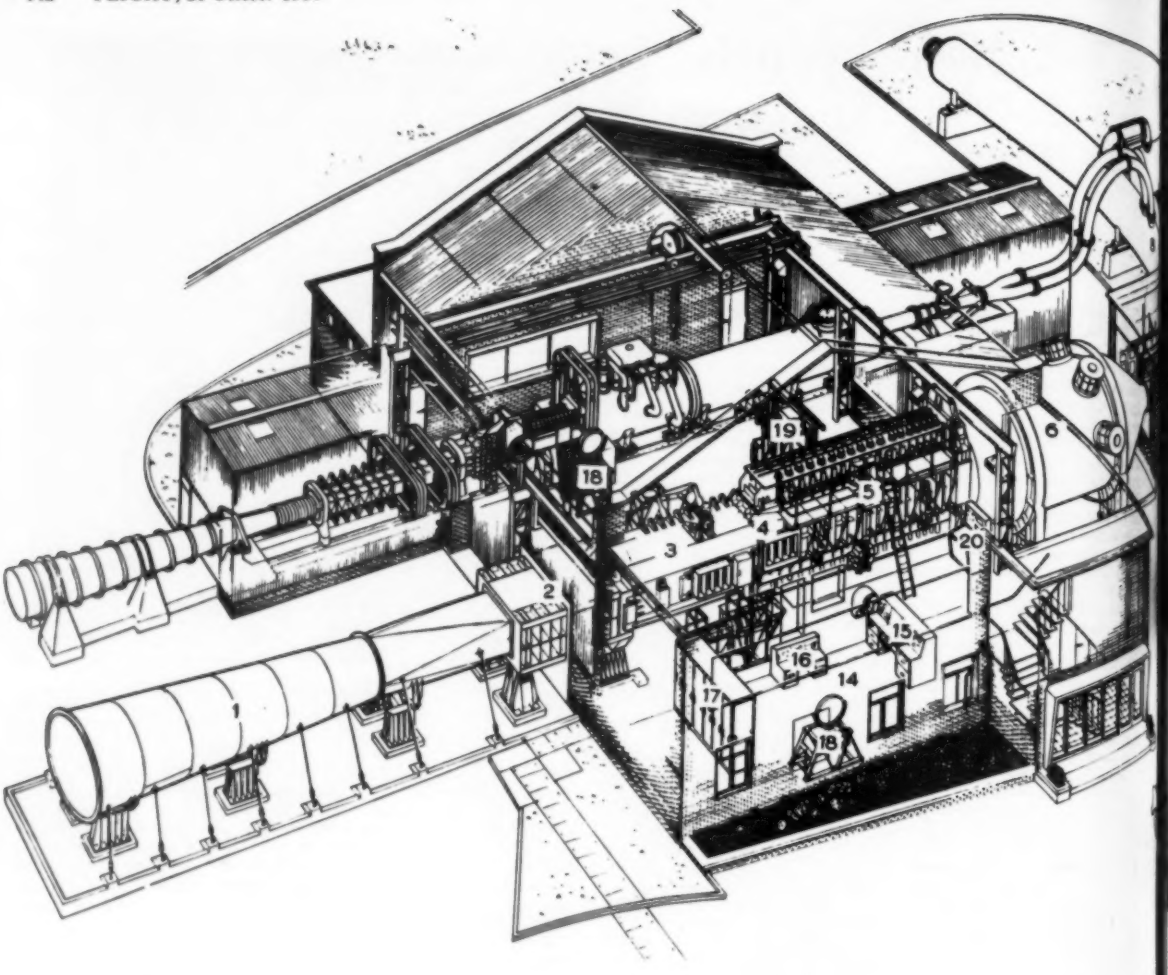
Air Supply As the drawing overleaf shows, compressed air is stored in four cylindrical bottles, each 90ft 6in in length and having an internal diameter of 6ft. When fully charged to 600lb/sq in the four bottles contain some 34,000lb of air. The bottles are pressurized by a pair of three-stage reciprocating compressors, each driven by an 820 h.p. motor, which together deliver 4,400 cu ft/min. The delivery is cooled by air/water heat exchangers downstream of each compression stage, and an alumina drier between the compressors and the bottles maintains the stored humidity at below 0.0003lb/lb. Temperature-drop in the air leaving the storage vessels is reduced to not more than 25°C by heat transfer from a "sink" of mild steel made up into tubular matrix blocks inside the delivery from each bottle.

4ft-square Tunnel

Flow control Primary control device is the main control valve, which has a threefold function: to establish the desired flow with minimum air consumption; to maintain constant flow during the test period; and to shut down the tunnel rapidly on completion of the test and seal off the air storage completely. The rapidity with which the supply pressure can fall posed control demands beyond the capacity of any existing valve. It was finally decided to adopt a two-component design, with a sliding piston to provide coarse control and a ported rotating cylinder governed by a closed-loop system providing fine control. Both members of the valve are automatically closed by fail-safe electrical and hydraulic interlocks upon a signal from any of the pressure switches located throughout the tunnel. Provision is made for varying tunnel pressure during the course of a run.

Flexible nozzle Located between the settling chamber and the plenum chamber, the flexible nozzle raises the Mach number of the incoming air from below unity up to the value required in the working section. The sidewalls are fixed, but the upper and lower walls are flexible. Each is a plate of Monel measuring 27ft × 4ft × 0.5625in, mounted on rigid beams which run the complete length of the nozzle section. Each beam is hinged directly to the plenum chamber, and the upstream ends of the beams are mounted on hydraulic screwjacks so that the vertical aperture at the throat may be varied from 48in down to 2.5in. In order to provide correct nozzle contours, the Monel plates are secured to the beams only at the upstream and downstream ends, the intermediate links being provided by 18 pairs of hydraulic jacks which, according to signals precomputed for each Mach number, position each of the 18 wall stations within an accuracy of 0.002in. The joints between the flexible plates and the sidewalls are sealed pneumatically, and maximum curvature of the flexible walls is at all times sensed by elements linked to the hydraulic system to prevent overstressing the plate in the event of malfunction.

Working section The 4ft × 4ft transonic working section is located immediately downstream of the flexible nozzle. The walls are formed from four sheets of perforated plate of 19 per cent porosity, surrounded by a plenum chamber of octagonal cross-section. Immediately downstream of the perforated plates is a variable diffuser formed from two sections of adjustable plates controlled by screwjacks. These plates improve pressure-recovery,



This general illustration of the new facility of English Electric Aviation Ltd at Warton has been prepared by a company artist. Air is delivered from the compressors (11) to charge the storage bottles (8), which are then exhausted through either the main 4ft-square tunnel or through the 18in-square missile tunnel in the background. Major items are listed in the key on the facing page

New Tunnels for Warton . . .

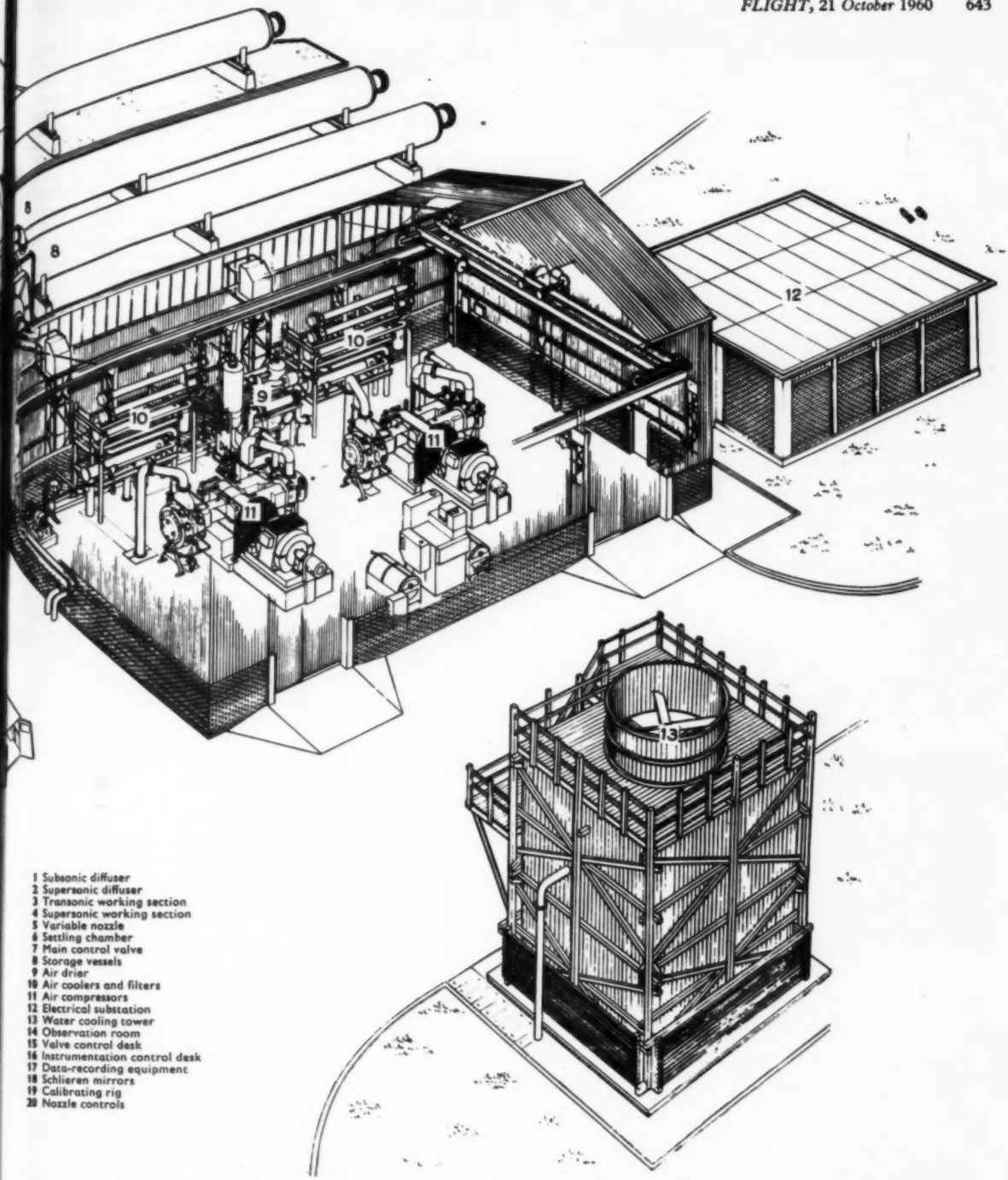
The valve control desk of the 4ft tunnel at the start of a run

and also provide suitable diffuser configurations for control at subsonic Mach numbers.

Model cart In addition to the model and its support system, the cart incorporates an incidence-changing mechanism and associated electronic and hydraulic equipment. Sting joints are interchangeable with those of the ARA tunnel and the 8ft RAE Bedford tunnel. The model may be turned about any axis, and a run may be programmed automatically to include fast and slow traverses and pauses at selected angles. To minimize shock loads, the tunnel can be started only with the model at zero incidence. The cart is mounted on wheels and can be run in below the plenum chamber in either the transonic or supersonic location.

Instrumentation Basic systems include straingauge signals, pressure surveys and Schlieren photography. Up to six force and moment channels and three pressure channels can be linked to chart recorders by d.c. signals, with simultaneous readout to temporary stores and final readout in coded binary form to punched cards. The pressure system can scan 48 points per second, with galvanometer recording. The Schlieren system incorporates two light sources, to facilitate continuous display and simultaneous high-speed flash photography.

Performance The Mach range 0.4 to 4 is a very valuable one, covering most flight conditions for the next generation of aircraft. Reynolds numbers are determined by the maximum stagnation pressure that the working section can accept, and a minimum value of 5×10^6 on a chord of 8in can be maintained under all working conditions. Maximum running time rises from 22sec at M1 to 41sec at M3.4; testing at maximum R at subsonic speeds reduces available time to approximately 12sec. Comprehensive force, moment and pressure surveys can be accomplished on com-



1 Subsonic diffuser
2 Supersonic diffuser
3 Transonic working section
4 Supersonic working section
5 Variable nozzle
6 Settling chamber
7 Main control valve
8 Storage vessels
9 Air drier
10 Air coolers and filters
11 Air compressors
12 Electrical substation
13 Water cooling tower
14 Observation room
15 Valve control desk
16 Instrumentation control desk
17 Data-recording equipment
18 Schlieren mirrors
19 Calibrating rig
20 Nozzle controls

plete models, facilities are projected for similar work on larger half-models, and, since stagnation pressure can be varied, the tunnel is very suitable for buffet and flutter tests and for the measurement of dynamic derivatives. Jettison tests are also envisaged.

18in-square Tunnel

Smaller than the 4ft tunnel, but having a maximum working Mach number of 6, this facility was installed for the Guided Weapons Division, but could also be very valuable in the development of advanced aircraft.

Flow control system From storage the air passes through two valves in series. The first is a stop valve, and consists of a quick-action butterfly, with a diameter of 18in, sealed by the contraction of a diaphragm-mounted ring (expanded by electrical heating) on to its periphery. The second valve, used solely for control, is a 10in-diameter cone which is unseated and then rotated to maintain the prescribed airflow. A servo system maintains running pressure in the settling chamber within ±0.25 per cent of the chosen value, and at any time both valves may be rapidly shut, either manually or automatically.

Flexible nozzle Like its larger counterpart, the nozzle has fixed sidewalls and a flexible top and bottom. The latter are large sheets of stainless iron connected to stainless-steel throat blocks, and their profiles may be varied by means of screwjacks attached to the throat blocks and by 11 hydraulic rams and three screwjacks attached directly to the plates. As in the 4ft tunnel, the nozzle profile can be held within ±0.002in, the sides of the flexible plates are sealed by inflatable tubes pressurized from the settling chamber, and curvature-limiters at each jack location prevent overstressing of the plates.

[*continued overleaf*

New Tunnels for Warton . . .

Heater section From the valves the air passes through a multi-channel diffuser into a heater section contained within the main tunnel pressure-vessel. The heater is used primarily to prevent liquefaction in the working section above M4, and consists of five identical units each consisting of a stack of thin steel plates and electric heating elements, surrounded by a thin steel shell containing refractory concrete to reduce maintenance time. Design variation of stagnation temperature is ±2 per cent of the mean temperature in degrees absolute.

Working section This is a direct continuation of the nozzle, and is made up of the fixed sidewalls and the downstream ends of the flexible top and bottom. In the sidewalls are rectangular Schlieren windows measuring 24in×12in, which may be replaced by metal plates. Access to the model is obtainable only by withdrawal of the nozzle cart downstream.

Diffuser Located immediately downstream of the model cart, this improves the overall aerodynamic efficiency and reduces stopping loads. It comprises a variable two-dimensional section with moving sidewalls built up from three hinged plates positioned by hydraulic jacks at the hinge points. This section of the diffuser may be continuously adjusted while the tunnel is running. Immediately downstream is a transition running into a conventional subsonic diffuser cone of 6° included angle. The diffuser telescopes at the junction between the fixed and variable sections, and the winch which performs this function also serves to pull the model cart downstream to provide access to the model.

Model cart Models are sting-mounted, the present adaptor being to RAE Farnborough No 19 tunnel design. The sting is carried on a quadrant attached at either end to the cross-beams of yokes centred on the working-section windows and running on bearing surfaces around the windows themselves. In the course of each run models may be subjected to any combination of roll and pitch; continuous roll may be imparted in either direction at up to 2rev/sec, and any pitch-rate up to 2°/sec can be chosen with the facility of an emergency return to zero incidence at 25°/sec.

Instrumentation Systems are provided for handling pressures, forces and moments, and for Schlieren photography. Most data are supplied as analogue d.c. voltages, from which discrete values are extracted, converted to binary form, temporarily stored and finally transferred to digital tape from which punched cards are produced for the Deuce computer. The system can extract data upon command from either the pitch or roll transducers or when instructed to do so by the operator, and up to 80 data points can be handled per second. In parallel is an analogue (12-channel galvanometer) system providing direct sampling information during the course of a run. The Schlieren window has a length of 12in, and photographs may be taken along the length of the windows under remote control, successive viewing positions—varied to match the length of the model—being traversed in 5sec.

Performance It is envisaged that this tunnel will handle models roughly 17in in length of vehicles having a full-scale length up to about 50ft, and that runs at between M1.5 and M6 will be accomplished at Reynolds numbers corresponding to full-scale flight at heights greater than about 80,000ft. Owing to the capacity of the data-extraction system, and to the fact that models may be simultaneously pitched and rolled, utilization during a run should be very high; minimum running time should always exceed 30sec, and in practice it should be possible to obtain the desired information in a much shorter period.

CONTRIBUTORS

THE following are the principal contractors for the work, as named by English Electric in a recent announcement.

Main air storage vessels, Whessoe Ltd, Darlington; civil engineering and erection of buildings, George Wimpey & Co Ltd; main air compressors, Harland & Wolff Ltd, Belfast; electric-motor drives, English Electric Co Ltd, Stafford.

4ft tunnel Working section and diffuser, Hall Engineering Ltd, Shrewsbury; settling chamber, Whessoe Ltd, Darlington; flexible-nozzle plates, Henry Wiggin Ltd, Birmingham; control valve, Johannes Erhard H. Waldenmaier, Heidenheim; control system, English Electric Aviation Ltd, Warton; hydraulic system, Keelavite Hydraulics Ltd, Coventry; relief valves, Swinney Bros Ltd, Morpeth; Schlieren system, Pilkington Bros, St Helens, and Optical Works Ltd, Ealing; Instrumentation, Leeds and Northrup Ltd, Birmingham (recorders), Panellit Ltd, Boreham Wood (recorders), CEC (diaphragm transducers) and General Design Corp (Scanivalves).

18in tunnel Working section and diffuser, Hall Engineering Ltd, Shrewsbury (main contractors); piping, Aiton & Co Ltd, Derby; stop valve, James Gordon & Co Ltd, Stanmore; control valve, Compudyne Corp, Hatbro, Pennsylvania; pressure vessel, John Thompson Ltd, Wolverhampton; heaters, AEI, Manchester; control system, John Brown Ltd, London (constructors); Schlieren system, Optical Works Ltd, Ealing; instrumentation, New Electronic Products (galvanometers), Langham Thompson (diaphragm transducers); data-handling system, English Electric Aviation Ltd, Luton.

"BROOKIE"—AN APPRECIATION

T. W. BROOKE-SMITH, AFRAeS, chief test pilot of Short Bros & Harland Ltd, has retired from active test flying, though not from less specialized kinds of aviation. The following appreciation of the man and his career has been written by a colleague.

WHEN Tom Brooke-Smith climbed out of the Short SC.1's cockpit at the end of Farnborough Show week, on Sunday, September 11, he said simply—according to one of our national dailies—"That's it!"

Whether this was factual reporting or merely journalistic licence is largely irrelevant. The fact remains that this was "it" in so far as Brookie's career as a test pilot was concerned. It not only marked the culmination of eighteen years of test-piloting but also heralded, following his superb demonstration of the VTOL aircraft, the beginning of a new era in flight.

In common with most test pilots, Brookie has never sought the limelight, and yet the publicity which he and his aircraft received at Farnborough is typical of that which has spotlighted his work through the years. Much of this is due to the research aeroplanes with which his name is associated—Sherpa, SB.5, and above all, the SC.1—but an appreciable share is also due to the man himself. Brookie was a "personality" long before the term became a hackneyed one.

Educated at Bedford School and at the College of Aeronautical Engineering, he began flying at Brooklands in 1934. He made his first solo in a Gipsy Moth on his seventeenth birthday; became the proud owner of a Puss Moth shortly afterwards; and used it to fly home to Lincolnshire at weekends.

After piloting for several charter companies he took a job with Air Despatch, and 1940 saw him stationed in France, flying Rapides on Army and RAF communications. He joined Air Transport Auxiliary in the following year, and in 1942 came to Belfast to open the Stirling Pilots Pool for delivery of the four-engined bombers which were then streaming off the Queen's Island production line. This was his first contact with Shorts; and his appointment as assistant test pilot, soon afterwards, marked the beginning of an association which was to last unbroken until his retirement this year. He became chief test pilot in 1948, after a course at the Empire Test Pilots' School.

From the end of the war he had been largely concerned with flying-boats—Hythes, Sandringhams, Solents and Sealands—with the Sturgeon twin-engined target-tug thrown in for good measure, and in 1950 he was sent to the West Indies to carry out route surveys for the proposed operation of small flying-boats in the Caribbean. In the following year, when he piloted the Sperrin on its initial test flight, from Aldergrove, he became the first man in Britain to fly a four-jet bomber.

Inevitably Brookie encountered his share of "close things," but it was not until 1951 that he had an accident which might well have ended the flying career of a less determined man. An experimental glider—forerunner of the jet-powered Sherpa—which he was testing at Belfast was caught in the slipstream of the towing aircraft and crashed on the runway. Brookie was lifted from the wreckage with a broken back. But he was at work again in the following year, flying the SB.5 adjustable-wing aircraft—to find a suitable wing-form for the Lightning—and in 1953 he piloted the Sherpa itself, to prove the design of the aero-isoclinic wing.

All told, Brookie has flown 150 types of aircraft, from sailplanes to airliners, from helicopters to bombers. But his outstanding achievement has undoubtedly been the flight testing of the SC.1, the world's first fully stabilized jet flat-riser. He has been concerned almost exclusively with this aircraft since its first conventional flight at Boscombe early in 1957. His major role in its development was marked, in February 1959, by the award of the Derry and Richards Memorial Medal by the Guild of Air Pilots and Air Navigators, in recognition of his outstanding contribution to the development of British aircraft.

Since his retirement, Brookie, his wife and their two children have moved house from Northern Ireland to Hampshire. He has a busy future planned, including a partnership in an aircraft rental business—to keep him from being grounded completely. But he also has a major project in hand which is still as security-veiled as many of the aircraft he has flown. Whatever it may be, he carries with him the good wishes of the entire industry for its success.

T. G.

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Clouded Horizon

I AM encouraged to read the leading article in this week's (September 30) issue of your magazine, stressing the need for a Government re-appraisal of light aviation.

In spite of the increase in aircraft sales, and the intense public interest, no such re-appraisal has been forthcoming, and indeed there are ominous signs that indirect attempts will be made to suppress completely the private aviation movement.

I believe that the next few months will be some of the most critical in the history of British private aviation, and therefore of British aviation in general. I sincerely hope that your magazine will devote as much space as possible to the causes of the light aircraft and the private flyer. There is much more at stake than the well-being of a section of aviation; the right of the individual to fly himself is at stake. This is a basic freedom synonymous with sailing a boat on the high seas, or driving a vehicle on the roads. To tamper with this freedom unwisely or unnecessarily is to create the most dangerous of precedents.

Redhill Aerodrome, Surrey — J. V. HOSE,
Director, Business Aviation Ltd

ON page 540 of your issue of September 30 it is suggested that one of the best ways of encouraging private flying might be "to introduce follow-up training to standards higher than for the Private Pilot's Licence."

The ABAC did just this in 1956 by introducing an advanced course to be taken in two stages as a follow-up to the Private Pilot's Licence course. The two stages of the ABAC advanced course comprise 14½ hours' dual and 13 hours' solo and include instrument flying, night flying, aerobatics and pilot navigation. At the end of the course a pilot should have obtained his restricted R/T Licence and his Night Rating.

The ABAC "Star Pilots Wings" badges may be worn by pilots who have successfully completed this course, Stage I having one star and Stage II two stars.

Our pilotage committee is now considering a revision of this course in the light of the experience gained since it was introduced in 1956.

London SW1 — E. SOUTHERN,
Secretary, Association of British Aero Clubs and Centres

From Air Cdre G. J. C. Paul, CB, DFC, AFRAeS

AS a private owner based on Fair Oaks, I read with alarm your paragraph (September 30) about the future of this airfield. I agree wholeheartedly about the urgency of solving the problem you describe. But the first need is to know whether the tenants themselves, who are in fact a wholly owned subsidiary of the Hawker Siddeley combine, have done something about it. If it is the policy of Hawker Siddeley to try to keep Fair Oaks going, they will receive my enthusiastic support.

But so far it has not been made known, at any rate to their customers, what their intentions are. Until this is done there is no policy which one may support; nor is it reasonable to make representations elsewhere. It seems to me, therefore, that the first move must come from the tenants; and, in this particular case, it amounts to a declaration by half the industry of its policy towards light and/or general aviation.

Fleet, Hants — G. J. C. PAUL
(Owner of Turbulent G-AJCP)

Church Steeples

THE news that the Chancellor of Worcester Diocese has rejected the petition by the Minister of Aviation for the removal of the spire of St Edburga's Church, Abberton, near Pershore, is an interesting example of the British way of dealing with these matters. In deciding questions of flying obstruction, a knowledge of heavenly things evidently gives more authority than any amount of practical experience in aviation.

The church in question, on the admission of the Chancellor, is little used and he would be glad to see a diminution in the number of churches in this country; but not even one of their spires must be sacrificed to safeguard the lives of airmen. Because nobody has yet had an accident due to the steeple, in the kind of flying done at Pershore during the last three years, the Chancellor appears to be satisfied that the risk in the future is of no consequence.

There was a somewhat similar case at Düsseldorf in 1949, when it was considered that the spire of the Deakoness Anstalt constituted an obstruction to what was then the main runway, although the aerodrome had been in active operation for many years. To begin with the Pastor wrote to Lord Pakenham and the Archbishop of Canterbury about this "catastrophe which is about to befall us," but that didn't cut any ice and the spire came down. The church really looked just as good with its square, low-roofed turreted top after the removal of the steeple, and the aerodrome was very much safer.

I agree that we should not lightly cast aside buildings of aesthetic value which have been handed down to us by former generations, but there is such a thing as striking a balance between objects of beauty and the safety of human life in aeroplanes. Where these conflict, I would submit that the Chancellor of a Diocese is unlikely to be the most impartial witness.

London W1 — JOHN GRIERSON

Jet Fuel and Safety

A FURTHER case needs to be added to the list of accidents to kerosine-fuelled aircraft appearing in my article "Jet Fuel and Safety" (June 10).

While landing at La Guardia, a kerosine-fuelled Electra crashed, overturned and burst into flames. All 76 occupants walked away almost unhurt, after which the fire largely destroyed the aircraft.

Although investigation is still in progress, it is well to draw attention to this accident while it is still fresh in the public mind; and unless and until the contrary is proved, it is not unreasonable to assume that this accident has provided the finest demonstration to-date of the greater safety of kerosine fuel.

And yet, Mr Hagrup and others are saying that no one can tell whether or not one fuel can be safer than another.

Harpenden, Herts — J. W. RICKARD

[Our correspondent is referring to the Electra accident which occurred on September 14.—Ed.]

Credit to Griffith

YOUR issue of August 26 records the retirement of Dr A. A. Griffith from Rolls-Royce and mentions a few of the debts the world of aviation owes his advanced thinking. One that is often overlooked today is his proposal for burying a turbojet propulsion engine within a rather thick wing and using powered suction to maintain low-drag laminar flow around the outside of the wing. In 1947 Prof Sydney Goldstein devoted the whole of his Wright Brothers' Lecture to this subject, introducing it as "the story of the researches carried out in Great Britain arising from an idea due to Dr A. A. Griffith . . . [which] was, if boundary-layer suction is to be applied, the shape of the solid surface should be specially designed."

Although much valuable work was done in England on low drag/boundary-layer control in the forties, the Griffith aerofoil concept was far ahead of its time and has been neglected for the past ten years, its importance obscured by the ballyhoo surrounding the jet flap. Among all the vast army of aeronautical "researchers" in the world only three under-privileged groups (led by Lachmann, Pfenninger and Raspet) have continued to make important contributions to the engineering of LD/BLC. However, the recent award to Northrop for full-scale flight tests gives hope that the turbulence barrier may eventually be dissolved; and maybe some form of integrated Griffith-type suction-jet is not so far off now.

Fairfield, Conn — J. M. STEPHENSON

The Name of Handasyde

I REFER to earlier correspondence relating to the question of a suitable tribute to perpetuate the pioneer name and work of the late G. H. Handasyde. As the idea has been approved and acclaimed as an excellent one, it will be of interest to readers to learn that a most fitting offer has been tendered from Australia, this being the offer of an Eagle aircraft in such excellent condition that it can be flown back to this country. This machine must be about the last, if not the very last, of the Eagles. As readers may know, the Eagle was one of Mr Handasyde's later products, his latest being the Double-Eagle which was primarily designed for Australia, and acclaimed in an official report as the best of its class to be flown.

It had been hoped that it might have been possible to restore one of his earlier designs of Martinsyde but it was found that no specimens now exist except the one owned by the Finnish Air Force, which is being retained for their museum.

As the Australian Eagle must be the last of his many creations, and being in such excellent condition, it would represent a most fitting tribute to the memory of its designer while at the same time symbolizing an appropriate foundation-stone for the rebirth and perpetuation of the old pioneer name as he so desired. Prior to his death it had been planned to construct an up-to-date small twin-engined executive-type aircraft with a top speed of 250 m.p.h., for which he considered there would be a wide market, now being proved today, and at that time there for the taking. Also at that time, certain firms very graciously offered to assist towards the construction of the prototype by subscribing and supplying the necessary components. However, due to his lengthy illness

CORRESPONDENCE . . .

and ultimate passing, the plan for the early marketing of this executive aircraft was disrupted.

Recently there has been much comment about the urgent need for a British-built executive type, and while one or two of our constructors are now giving the matter serious consideration, there would appear to be some hesitancy in the matter, no doubt partly due to the inroad of American and Continental types upon this market. Perhaps this presents the opportunity of securing the co-operation of the industry in constructing the prototype as an added tribute to one of their early colleagues. This might be one way of spreading over the initial cost of a prototype, while it would gauge the market prospects for a British-type small executive. [This was written before the formation of the BEAGLE Group was announced.—Ed.]

With regard to Handasyde's executive, it is most fitting to mention here that his plans incorporated an arrangement whereby the aircraft would be suitably represented in Australia. As many of his earlier aircraft found a market in Australia, it is very gratifying that this Eagle offer should emanate from there, while the fulfilment of this unique Eagle flight from Australia to here would memorably mark the occasion.

In view of this initial and helpful Australian gesture towards the furthering of this worthy cause, this letter is written to invite interest and support from members of the industry and others who would be willing to co-operate towards bringing about this tribute flight, which in turn brings about the rebirth of that pioneer name of 1908 in the new era.

Edinburgh 7 S. H. HANDASYDE

"The Flying Years"

THE second instalment of the BBC's television series *The Flying Years* was nearly as inaccurate as the first—but not quite. For Sir Alan Cobham might at least have been expected to get the facts right about his own best known flight, which took up much of the programme.

In spite of advance warning the BBC wouldn't alter the pronunciation of Sir John Alcock, calling it "Orlcock" instead of the correct way, rhyming with "pal." And Sir Alan called Harry Hawker's Sopwith Atlantic the Atalanta, confusing it with a contemporary Fairey flying-boat.

He also perpetuated the untrue story that Hawker's engine failure in mid-Atlantic was caused by rust or something in the radiator, which stopped water circulation and caused overheating. About ten years ago I was broadcasting in Nassau with Fred Sigrist and he told me the real truth—which has since been published in the *Royal Aero Club Gazette*, so Sir Alan ought to have known. When the aeroplane was salvaged, Fred and Harry went to the docks to see if they could discover what went wrong. Fred noticed that the radiator shutters were fully closed, which would have caused the overheating. Harry admitted he was unfamiliar with this aeroplane and thought that when the radiator shutter lever was where they found it the radiator should be fully open.

One would have thought the BBC would have gone to some trouble to consult people who knew; yet it looked as though they only consulted the sort of historian who takes his facts from old newspapers. But at least the BBC should have the grace to broadcast an apology for the slur on Hamel; for he has many friends still living who were outraged by Sir Alan calling him "a crack German pilot."

London W14 GEOFFREY DORMAN

"Record" Passenger Loads

I WAS much interested to read Mr Richard P. Bateson's letter (August 19 issue) and, as he rightly says, the carrying of 340 personnel of the German forces by a Messerschmitt Me323 in the "panic" evacuation from North Africa in 1943 must surely rank as an unorthodox and certainly unique achievement.

So far as the carriage of 293 passengers (including, most probably, large numbers of children) plus ten crew in a Boeing 707-329 *non-stop* from Leopoldville to Brussels is concerned: not only does this achievement rank, unofficially of course, as a world's absolute record for the number of persons carried in a jet aircraft but likewise for the distance they were flown non-stop.

However, when one considers that in the past decade aeroplanes have quite successfully carried "passenger loads" of anything between 100 and 200 persons (including and excluding children) depending on the types of flights operated, it puts in its proper perspective the achievement of the Me323 during World War 2, under truly "panic conditions" coupled with absolutely no regard for the safety of the military "passengers" and crew. It involved what might well be described as "the millionth chance" of successful take-off and safe landing. In contrast, the carriage of up to 200 adult military personnel in several hundred flights by Douglas C-124 Globemaster 11s (and 300 or more could easily be carried in the vastly superior C-133 Cargomaster transports) are sound achievements.

Also, I am most certainly not overlooking the fine achievement of a "stripped" BOAC Britannia (series 300) which carried, I believe, some 202 adults and children Bahrein to Aden about two years ago. In addition, I recall that, back in 1949-50, two "stripped" DC-4s (chartered by El-Al), and Don Bennett's Tudor V, likewise "stripped," safely carried something like over 1,000 Yemeni Jews from Aden to Israel in a well organized "airlift": the record load, was, I believe, 179 "souls" in one of the DC-4s. And 125-150 aboard was quite routine.

Again, going back to 1949, we have the greatest number of passengers ever carried in a flying-boat. Little publicized then or since, this was a US Navy Martin Series JRM-2 Mars which carried 308 naval personnel, including a crew of ten, from Honolulu to San Francisco. It operated, needless to say, at max. a.u.w. of 165,000lb.

Turning back the clock to October 21, 1929—I would remind Mr Bateson of the (then) outstanding achievement when no fewer than 169 persons were airborne for about one hour in the fabulous Dornier DoX prototype, registered D-1929, over Lake Constance. And the DoX was then well under its max. a.u.w. of 122,766lb.

Nairobi, Kenya DENNIS POWELL

Show Models

I HAVE just read the September 30 issue of *Flight*, and have risen like a fish to a well-cast fly at the caption to the photograph on page 544, referring to a claim by a certain company to have been responsible for the biggest share of models in the SBAC Show.

I cannot imagine why anyone should be interested in knowing who is responsible for the biggest share of models in the Show, and I find it impossible to believe that anyone would go to the trouble of investigating every model therein and establishing by whom it was made. This would be quite a considerable undertaking, since Westway Models Ltd alone provided 243 models for this year's Show. A typical example is the aircraft illustrated on the front cover of the September 30 issue, and some of these models were to be seen on the stands of Vickers-Armstrongs, Hunting, Bristol, Short Brothers, Westland, Blackburn, Boulton Paul, A. V. Roe, English Electric and a number of other companies.

London W3 IAN WALKER,
Managing Director, Westway Models Ltd

Ten for Touring

WE notice with interest the photograph which appeared in your issue of October 7, on the "Sport and Business" page. The Auster G-APFW is one of the ten aircraft which we have available for air touring, with or without pilot supplied by us.

In view of the Khatmandu trip, I think we can honestly say our aircraft are available for worldwide hire, although they are more often used within the UK and Western Europe.

In passing, we feel that we must mention that your caption to the picture is not entirely correct as the undergraduate standing on the left of the picture against G-APFW is Dermot Boyle; John Brown is in the centre; and David Lomax, the captain of the trip, is on the right-hand side of the picture.

Grantchester, Cambs GRANTAIR LTD
G. W. Yates, Managing Director

CORRESPONDENCE IN BRIEF

"It really is a tremendous effort to part with these issues, but as I am engaged in a far less exciting world I really have no room for them," writes Mr Alex Hann, of 1 Old Pit Cottage, Norton Hill, Midsomer Norton, near Bath, Som, who is seeking to dispose of 50-odd issues of *Flight*, of various dates in 1940, 41, 42 and (two only, January 7 and 21) 43. "A 1s 6d postal order," he says, "should cover postage, wrapping and replies to other persons requiring issues not held."

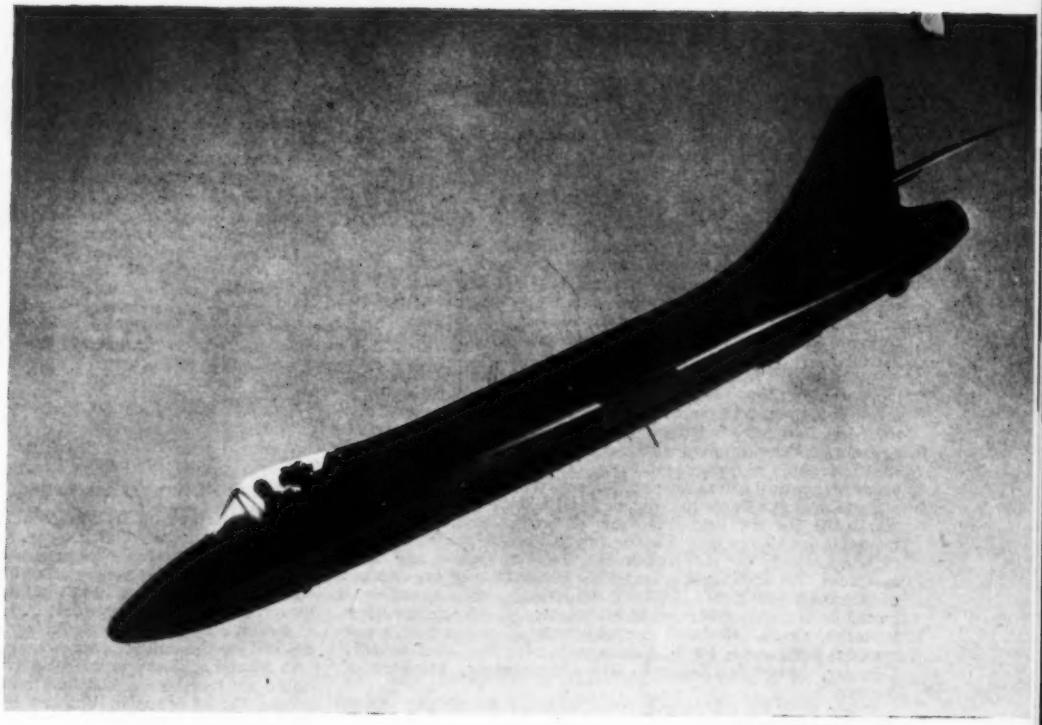
FORTHCOMING EVENTS

Oct. 25. Society of Instrument Technology (London): "Instrumentation, Past, Present and Future," by L. S. Yoxall.
Oct. 25. Institute of Transport (West Middlesex Group): "Economics of the Peak in Air Travel," by Garret Fitzgerald.
Oct. 26. Institute of Navigation: Annual General Meeting and Presidential Address.
Oct. 26. BritIRE (South Western Section): "Radio Aids for Automatic Landing developed by the Blind Landing Experimental Unit," by J. S. Shayler.
Oct. 26. Kronfeld Club. Talk by Murray Armor of Rhodesia.
Oct. 28. Surrey and Kent Flying Club: Annual Dinner Dance.
Nov. 1-3. Institute of Welding: Autumn Meeting.
Nov. 2. BritIRE (Radar Group): Discussion, "Radar—Pulse or C.W.?"
Nov. 3-9. Kronfeld Club: Painting Exhibition.
Nov. 4. Norfolk and Norwich Aero Club: Dinner and Dance.
Nov. 9. BritIRE (West Midlands Section): "Modern Computer Techniques," by K. C. Johnson.
Nov. 10. Radar and Electronics Association: "VHF Aerial Techniques," by C. A. Burgess.
Nov. 16. Kronfeld Club: Film Show.
Nov. 17. Guild of Air Pilots and Air Navigators: Annual General Meeting.

RAeS Branch Fixture (to Oct. 28): Oct. 25, *Glasgow*, "Evolution of Airlines," by Alan Williams. Oct. 26, *Weybridge*, film show.

INTO THE SUN

Tricks of the light provide striking new impressions of a Hunter F.6 of the Empire Test Pilots' School (diving supersonically at the moment the picture was secured) and of a Lightning F.1 on a delivery flight to the RAF



"Flight" photograph

THE INDUSTRY

Tiltman Langley Progress

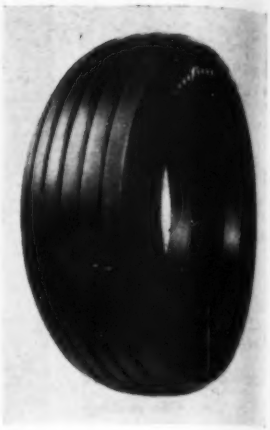
ORIGINALLY Tiltman Langley Laboratories, the firm of Tiltman Langley Ltd was established in 1947 to undertake research work into the basic strengths of materials for RAE Farnborough. The results of this work are embodied in *Design Requirements for Aircraft for the Royal Air Force and Royal Navy, AP.970*, and so have been used in the structural stressing of all British military and commercial aircraft.

Meanwhile, Tiltman Langley have greatly expanded their research and test facilities. ARB approval has been granted to cover the test house for the physical testing of ferrous and non-ferrous material, and the company also holds AID Test House Pt 3 approval for the examination of welded, spot-welded, and brazed joints.

A 20,000lb Macklow-Smith tension-compression machine (approved by Lloyd's Register of Shipping) is currently employed, together with an NPL-type axial fatigue machine, on research for the MoA into the strengths of joints. Other equipment includes a machine of the company's own design for determining torsional shear-strengths of tubes and bars; Vickers Hardness and Izod machines; optical extensometers; high-precision gauges; balances; a metallurgical camera-microscope; and a dark-room. Furnaces and baths for the heat treatment of ferrous and non-ferrous materials are also in use. Testing can be done over a wide range of temperatures on the tension-compression, fatigue and Izod machines. All such work is under the supervision of the director of research, Mr E. F. Maillard, BSc (Hons), AFRAeS, and is a particular interest of the technical director, Mr Marcus Langley, MIMechE, FRAeS. Research consultant on all metallurgical and material problems is Dr H. Sutton, CBE, DSc, FIM, until recently Director, Materials Research and Development, Ministry of Supply.

Other work by the company has included the fatigue testing of springs and joints, wear of piston rings and cylinders, strain-gauging, and the design and manufacture of test rigs for complex mechanisms and drives. The examination and testing of compressed-gas cylinders is also undertaken.

The central position of the test house—three miles from Redhill, Surrey—is particularly convenient to the industrial areas of South-east England.



Earlier this month the Goodyear Tyre & Rubber Co revealed the "Thermal" tyre, developed for the Bristol 188. It is claimed that by the employment of certain special techniques, involving "new formulations in compounding and developing materials used in the carcase and tread," the new tyre has roughly double the heat range of conventional tyres and permits the elimination of wheel-bay refrigeration

Low-temperature Refrigeration

A NEW, large-capacity Philips industrial refrigerating unit has been announced. Based on the same makers' single-cylinder unit, it is intended for more general applications, being described as "suitable for direct condensation in distillation processes, liquid and gas-stream cooling, and for allied industrial operations calling for refrigeration in the temperature range down to −200°C and at a pressure range up to 450lb/sq in." Further characteristics claimed for the unit are compactness, and reliability in operation.

A special auxiliary unit is also available for the production of liquid air from the atmosphere; and a fractionating column, to produce liquid nitrogen, is under development. Like the existing Philips models, both these units operate without the use of pumps or chemicals, suction created by condensation being utilized to draw in the air supply. Moisture, carbon dioxide and other impurities are removed by a freeze-drying technique.

Distribution in the UK is by Research & Control Instruments Ltd, Instrument House, 207 King's Cross Road, London WC1, who also offer an advisory service.

IN BRIEF

The London office of English Electric Aviation's Aircraft Division has moved from Marconi House to 100 Pall Mall, SW1 (telephone Whitehall 1020). The office is under the control of Air Cdre Strang Graham, commercial director.

Hadfields Ltd, of Sheffield, recently appointed two further local directors: Mr Denis R. Ward, FCA, the company's assistant secretary, and Mr Arthur W. Gurney, ACWA, chief cost accountant.

Mr A. J. Shirley, chief draughtsman of the M.L. Aviation Co Ltd, has been appointed to the board. He joined the original design group of M.L. Aviation in 1941.

The Plessey Co Ltd have entered into the final stages of negotiations to take over the 66-acre former RAF balloon barrage station at Titchfield, on the A27 London - Southampton road. The company is to establish a new production centre there.

Recent staff appointments at Atton Developments (Woking) Ltd are those of Mr R. T. Pretty—formerly with Vickers-Armstrongs (Aircraft) Ltd—as manager; of Mr T. M. Tamblyn-Watts as senior visualizer and typographer; and of Mr A. R. C. Holland as senior technical author. Like Mr Pretty, "Dutch" Holland comes from Vickers and has had 34 years' experience as a pilot. The company, whose head offices are at 49/50 Maybury Road, Woking, Surrey, are specialists in the preparation of technical publications and publicity.

Mr J. C. Reed, formerly sales engineer of Birmingham Aluminium Casting (1903) Co Ltd, the light-alloy founders of Smethwick, Staffs, has been appointed sales manager.

Mr R. E. Ford has been appointed divisional manager of the newly created Airborne Radio and Radar Division of Elliott Bros (London) Ltd, a member of the Elliott-Automation Group.

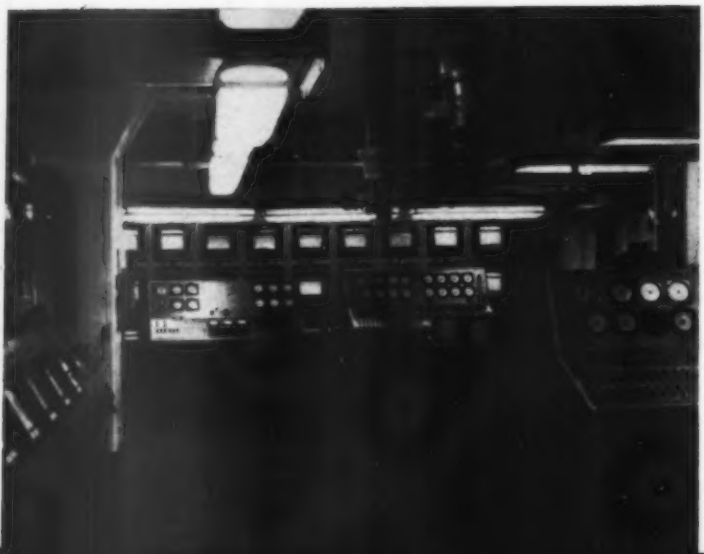
Mr P. T. Griffith, AFRAeS, AMIME, has been appointed aviation consultant to the Caltex (UK) Co Ltd. Formerly with BOAC as purchasing controller, Mr Griffith is managing director of the Babb Co (Britain) Ltd.

Valay Industries Ltd, makers of the Jove Aero Products range of aircraft cleaning and polishing materials, have moved to new premises. Their address is now Davis Road, Chessington, Surrey (tel Lower Hook 2166; telegrams and cables: Valaypro, Chessington).

Mr George Orloff, MIMechE, AFRAeS, has joined the Industrial Division of the Sperry Gyroscope Co Ltd as a consultant. A member of the Society of Instrument Technology, he is well known for his work in connection with the introduction of 4,000lb/sq in hydraulic systems for a number of aircraft types and also for his developments of flapper spool servo valves.

Electrolube Ltd, Oxford Avenue, Trading Estate, Slough, Bucks, are making their electrical-contact lubricant available in pocket-type dispensers of fountain-pen size. Two varieties are available, one for cleaning and lubricating non-arcing contacts and mechanisms and the other for lubricating cleaned arcing contacts. The dispenser gives either a drop or a stream of the lubricant at will.

As part of a general reorganization of the sales staff, James Booth Alumium Ltd (Argyle Street Works, Birmingham) have appointed Mr Arthur W. Williams, BSc, AIM, chief technical representative in charge of their technical sales service department. Mr Williams, who joined the former James Booth & Co Ltd in 1939, was appointed chief inspector in 1955 and for the last two years has been personal assistant to the works director.



Pye Ltd, Honeywell-Brown, Metrovick, DH Propellers, SE Laboratories and New Electronic Products are among the companies which installed instrumentation at the Rocket Propulsion Establishment, Spadeadam (described in our September 16 issue). This illustration shows the interior of a control room in the Engine Test Area

Straight and Level

LAST week that great man of British aviation, Sir Charles Boost, affectionately known as Boostie to his many friends, called a news conference in the Mayfair offices of Plummet Air Lines, of which he is chairman.

"As some of you may have read in the papers," announced Sir Charles, winking coyly at the air correspondent of the *Daily Clanger*, to whom he had leaked the story the day before, "Plummet Air Lines are now ready to enter into pool agreements with BOAC and BEA." There was a wild burst of applause.

"I am glad you appear to approve," Boostie beamed. He winked at the air correspondent of the *Daily Excess*, to whom he intended to leak another story over a drink afterwards. "You don't need me to remind you of the value of these pools, which are the very foundation of Britain's proud place in the forefront of world air transport today.

"Our aim, we Plummeters, is to rely on the BOAC and BEA world-wide sales organizations to sell our seats for us. And with the great resources of these two fine corporations behind us, our financial problems will be at an end, British air transport as a whole will gain immeasurably and . . . and . . . well, anyway, if foreign airlines have pools with BOAC and BEA, why shouldn't we, eh?"

After the tumultuous applause had died down, someone asked whether the Minister of Planes approved of pools. "It's none of his damned business," snorted Boostie. "Anyway, when I did once mention pools to him he replied: 'Pool? Pools? You'd better talk to my colleague the Minister of Football about pools.'" The news conference ended in a roar of laughter.

● The US firm Umbaugh, who have designed the Lycoming-engined Type 18 two-seat autogiro, claim that they have received 10,000 deposits for the aircraft, that Fairchild's Hagerstown factory will produce 240 by October and 640 by November. When "peak production" is reached, 72 Umbaughs will leave the production line every day.

Let's look at these figures. Those 72 Umbaughs a day would add up to 26,280 a year. That would double the American business and touring aircraft fleet in two or three years. The rotor-blade manufacturers would have to turn out 78,840 good, safe blades per year—or nine blades per hour, 24 hours a day. Someone will have to train at least 26,280 new Umbaugh pilots each year. And there are likely to be more than 600 Umbaughs flying before the first prototype has a C of A.

But then other people in aviation have been known to have problems—usually the problem of no orders. Which doesn't seem to be one of Umbaugh's problems.

● *"Fortunately we had backward-facing seats, and the only effects we felt were to be forced back into the seats."* —Mrs Hannah Buckman, passenger on board the Falcon Airways Hermes which overran the runway at Southend as reported in *The Times*, October 10.

"Many passengers could have been badly hurt if our seats had not faced backwards."—Mr Derek Dicks, also a passenger in the aircraft, as reported in the *Daily Mail*, October 10.

I am tempted to remount my old backward-facing hobbyhorse, but perhaps comment is unnecessary.

● United's proposed take-over of Capital Airlines is likely to lead to several more big US airline mergers. Already TWA is proposing to take over Northeast—another big fish swallowing, relatively speaking, a little fish.

There are four big fish among the US domestic airlines: United, Eastern, American and TWA. There are any number of possible variations and permutations on who will take over who.

The problem of digestion is, I imagine, tremendous: it is very nice to acquire new routes and to reduce competition (something which is giving the Civil Aeronautics Board concern). But there is a size in the airline business beyond which the economies of large scale can no longer be reaped, whereupon cost level tends to go up rather than down.

I still think that the small airline is the one which has potentially the lowest cost level. It would be sad to see too many little fish being swallowed up.

● So the Government has decided to accept the recommendations of the Chandos committee and grant a loan of up to £18m on a new "Queen" liner for Cunard.

What, you may ask, has this got to do with aviation? *Point 1:* In 1958 North Atlantic air traffic overtook sea traffic and it will never look back. *Point 2:* This year, for the first time, more people are travelling to and from this country by air than by sea. *Point 3:* This month the Atlantic air fare was cut below the sea fare for the first time. *Point 4:* This month special new low "Skycoach" air fares are being introduced to British points overseas.

What, if anything, did the Chandos committee report have to say about these trends? We do not know, because the full report was secret.

If I had any money to invest, I think I would do what Cunard themselves did six months ago—put it in airlines.

Guard That Mixer

● "Milan, runway 35R/17L—Surface: Macadam with heads in concrete."—*From Italian Notam* 387/60.

ROGER BACON

Left, I'm getting quite a response to my "retired aeroplanes still in service" inquiries. Here is a DC-3 doing duty as a restaurant near Paris/Orly

Right, aviation's worst structural design-case—the female stiletto heel. Boeing sent me this picture to show how closely they are studying the problem

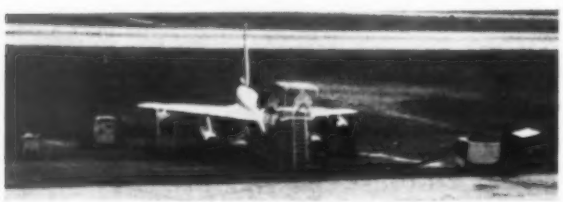
FLIGHT SYSTEM SURVEY

Universal Automatic Check-out

AT a briefing for members of English Electric Aviation at the offices of Bendix Ltd in London last week, a representative of Bendix Support Equipment, Teterboro, gave details of a new check-out system called PC-300. First ordered by the USAF and about to be delivered for the Sky Bolt programme, the PC-300 is intended as a flexible programming device for the automatic control of check-out sequences for any missile, aircraft or complex commercial system. The military designation in the Sky Bolt system is AN/GJQ-9.

PC-300 is basically a single, accurate, self-checking programmer comparator which can be coupled through an adapter to appropriate test connections in an aircraft, missile or industrial process and which can perform pre-set test sequences under control of a pre-punched paper tape. It contains highly accurate frequency and time standards, special power supplies and computers and may be used on the production line, during overhaul, at reception inspection, in a spares depot, in a hangar or on the flight line. In the last-named case a go-no-go check would be run. In the first-line servicing hangar the equipment would identify faults at sub-assembly level. In all other cases faults would be traced right down to individual electronic modules.

Automatic check-out of this general type is now produced by Bendix Support Equipment to check the power control linkage assembly in the B-58 Hustler which is responsible for mixing lateral and longitudinal autopilot demands to the elevon controls. The B-58 cannot be flown at maximum performance manually and maximum elevon deflection is only 3°. At high Mach numbers surface deflection is said to be limited to only 7min. Other Bendix equipment is used to check the instruments and air data computer of the B-58. The equipment is housed in a single four-wheel trailer. Similar equipment, also housed in trailers, has been supplied by Sperry for the bombing/navigation system and by other manufacturers for yet more systems. All this adds up to a

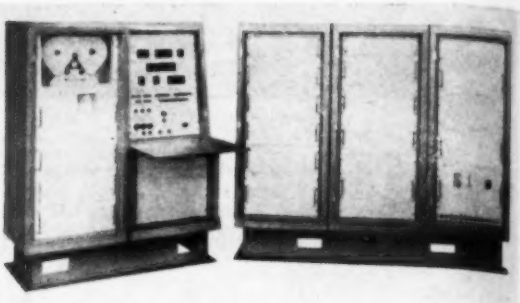


A Convair B-58 Hustler with some of the check-out and power-supply vehicles, which could be replaced by a single mobile PC-300 and a selection of programme tapes

sizeable convoy which must cluster round the B-58 during its three-hour preflight check-out. The use of automatic equipment reduced early pre-flight times from ten days to three hours, but each manufacturer was then in the position of having to supply his own analogue-to-digital converters, power supplies and computers. The Bendix PC-300 allows the use of a single set of these components with an appropriate tape control, read-out and print-out system and a variety of adapters to carry out virtually any test through the same basic equipment.

One of the main tasks is for Bendix and the manufacturers of the equipment to be tested to provide suitable adapters. Furthermore, the many connections within the aircraft or weapon—and electrical pick-offs from mechanical systems where necessary—must be provided so that automatic check-out methods can be applied. Sky Bolt has been designed from the outset to have a single umbilical connection so that the PC-300 may be plugged in for a programmed check of ten of its complex sub-systems.

The B-52, which will be the USAF Sky Bolt launcher, did not receive this kind of treatment at the design stage and its functions will be reproduced during Sky Bolt check-out by a simulator. The B-52 itself will have to be checked by more conventional procedures. Although Sky Bolt is not due to be operational before 1964, the USAF has already ordered 24 GJQ-9 systems and has demanded a 300hr mean time between failures without loss of calibration. Britain would receive Sky Bolt complete with its associated ground equipment and the PC-300 will therefore probably be manufactured in Britain in due course. Whether the Avro Vulcan will be modified for automatic check-out in conjunction with Sky Bolt has not yet been stated.



Bendix Support Equipment's PC-300 cabinets, showing removable tape unit and visual read-out and switching panel

The versatility of the PC-300 means that the same basic check-out equipment can be used during manufacture, overhaul, in storage depots and on the flight line to give a universal checking standard. Considerable advantages could result in dispersed production programmes such as that of the F-104G in Europe where each manufacturer would otherwise have to design his own test equipment, but ensure a universal standard in the finished product. Programming, computers and adapters for the F-104G could be mounted on a Volkeswagen van and could completely check out one aircraft in between eight and ten minutes. It is noteworthy in this connection that a good deal of equipment in standard USAF and US Navy service, particularly compasses, director instruments, navigation computers and air data computers, have been designed with special test sockets intended to allow automatic pre-flight check-out. The Autonetics NASARR attack radar even has an automatic self-checking programme which operates continuously whenever the equipment is switched on.

An important possibility in automatic check-out equipment of this kind is that certain modifications to a new aircraft could be proved by the check-out equipment rather than by flight testing. A complete routine pre-flight check of a complex civil aircraft could be made by programmed automatic equipment and the printed record of the test results signed and submitted as an engineer's report acceptable to the airworthiness authority. It is reported that the FAA is close to accepting this principle, if only because something of the kind is inevitable if turn-round and maintenance times are to be kept at economic levels.

The PC-300 makes a parallel comparison of each test point measurement by a unique digital computation in which the high and low tolerance limits are applied simultaneously. The system can check DC and AC voltages, r.m.s. values, in-phase and quadrature components, voltage ratios, resistance, frequencies and time intervals. It can accommodate 200 test points and 100 channels of test stimuli, but these can be doubled by the addition of extra bays to the basic equipment. The control tape is 1in paper with eight levels, with a photo-electric sensor which performs conversions at 150 frames/sec. It can re-wind at 800 frames/sec. Test sequences can be carried out automatically, stopping at any fault; and the equipment can search forwards or backwards, re-wind, be operated manually or programmed to investigate a whole sequence of levels in one parameter. Print-out is on a 3½in paper tape which provides the basis of a statistical record of failures. Slow drifts within tolerance levels can be detected by analysis and the cause of recurring faults traced. In addition, visual indications and a digital read-out are provided.

In air data systems, for example, the PC-300 will provide a highly accurate air pressure at the pitot head and check the progress of the resulting signal right through the flight control system to the surface response.

In order to ensure reliability, a feed-back compares switching actions derived from the tape with the tape demands. One level of the programmed tape provides a parity bit to check the tape itself. Finally, a self-checking tape programme will analyse the PC-300 circuits by reference to its own secondary standards right down to a replaceable assembly or a group of three circuit modules. The standards include DC voltage accurate to 0.02 per cent, AC voltage to 0.05 per cent, resistence to 0.1 per cent, frequency to 0.001 per cent and in-phase quadrature voltage. The programme tapes are in cassettes to facilitate rapid changing and the adapters are mounted in the standard electronics bays measuring 2ft × 2ft × 5ft.

The PC-300 is estimated to cost between £32,000 and £35,000. A PC-400, costing something over £40,000, is capable of a four-digit instead of a three-digit read-out and is suitable for checking inertial navigation systems. The PC-100 is a smaller unit of interest to airline operators and costs between £16,000 and £17,000.

Jet airliner pioneers—BOAC de Havilland Comet 4 and PanAm Boeing 707. A note on the first two years of jets appears below

AIR COMMERCE

FIRST TWO JET YEARS

NEXT Wednesday, October 26, marks the second anniversary of the big-jet age. It was on October 26, 1958, that PanAm inaugurated the first passenger services with Boeing 707-120s—across the North Atlantic. Three weeks earlier, on October 4, BOAC had re-established its claim to be the world's pioneer jet airline by introducing the Comet 4 into passenger service on the North Atlantic. [*Stop press:* As planned, BOAC withdrew Comets from the North Atlantic last Sunday, October 16, all jet services now being by Boeing 707s. Comet 4s are now concentrated on the eastern and southern routes.]

Some facts and figures are appropriate. Up to October 4, the second anniversary of their introduction, Comet 4s—41 in all—flew a total of approximately 108,660hr. These were broken down as follows (not all the "hourage" totals apply precisely to October 4): BOAC, 83,200hr (19 in service); BEA, 8,920hr (seven); Aerolineas Argentinas, 10,800hr (six); Olympic Airways, 2,350hr (three); Mexicana, 1,300hr (two); Misrair, 1,900hr (two); EAAC, 390hr (two). These hours include manufacturing tests, crew-training and non-revenue flying.

As recorded last week, the number of revenue hours actually flown by BOAC in passenger service during the first two years of Comet operations was 68,500. The corporation worked its Comet 4s at an average daily utilization of 10.4hr (total fleet) during the five summer months of 1960. The aim is to step this up to 12hr next summer. BOAC have also been regularly achieving turnround times at London Airport of between two and three hours, and recently one individual Comet did ten round-trips across the Atlantic in a period of 11 days.

So far as maintenance is concerned BOAC Comet 4 man-hours per flying hour are now at the 9.17 level, which is said to be 20 per cent below the corporation's original budget estimate. Comet 4s remaining to be delivered by D.H. are: MEA, three; Misrair, one; Mexicana, one; BEA, three; Olympic, one; RAF, five.

The latest figures available for the Boeing 707 up to October 7 show that 162 Boeing 707s and 720s operated by 17 airlines have flown a total of 364,300hr and have carried 8,855,000 passengers for 14,100 million passenger-miles. Boeing have 22 customers, including the USAF, on the order book which now amounts to 250 aircraft. A further five 720s were ordered last week by Eastern Air Lines to supplement their existing order for ten. Since the beginning of 1960 Boeing have sold 40 707s, compared with 1 DC-8 sold by Douglas, whose big-jet orderbook is now 150 compared with Boeing's 250.

New Literature on Slush

THE bitter controversy that began at 1657.06hr at Munich Airport on February 6, 1958, abated—even though it may not have ended—at 0030hr on October 12, 1960, when the Fay Commission report on the accident to BEA Elizabethan G-ALZU was published.*

The Fay Commission was appointed by the Government on June 10, 1959,

"*to consider the representations made by and on behalf of Captain Thain with regard to the accident to BEA Elizabethan G-ALZU at Munich on February 6, 1958: and, having regard to those representations and to the Report of the German Commission of Inquiry on the said accident, to report to the Minister whether or not in their opinion Captain Thain took sufficient steps:—*

(a) to satisfy himself that the wings of the aircraft were free from ice and snow;

(b) to ascertain whether or not in the conditions prevailing at the time the runway was fit to use;

and (c) to ascertain the cause of the difficulties encountered on the first two attempts to take off before making a third attempt."

The members of the Commission were Mr E. S. Fay, QC; Professor A. R. Collar; and Capt R. P. Wigley.

The Commission was not set up to determine the cause of the accident, but their report leaves the reader in no doubt that ice on the wings was not, as was concluded by the German commission of inquiry, the "decisive cause" of the accident. Neither the pilot in command of the aircraft, Capt James Thain, nor the British Air Line Pilots Association ever accepted the German findings. BALPA submitted that the evidence did not establish the presence of ice on the wings and that the behaviour of the aircraft should be accounted for by the retarding effect of slush on the runway, rather than by wing icing.

The fresh evidence, says the report, consisted of statements (a) By three persons who took part in rescue operations and stated that they saw no ice on the wings when, immediately after the accident, they took part in extricating Capt Rayment from the wreckage, and (b) by two air traffic controllers, Erich Laas and Kurt Gentzsch, who watched the last take-off from the control tower. The latter both spoke of the aircraft making a normal run for the first half of the runway; the nose-wheel then left the ground but after some distance it touched down again, leaving the ground, according to Laas, once more before the end of the runway. (Gentzsch did not speak of the nose-wheel again leaving the ground, but thought the aircraft rolled to the end of the runway and then unstuck.) This was submitted as consistent *inter alia* with a nose-heavy pitching movement caused by running into deeper slush or by frozen slush retarding the free running of the wheels.

The German authorities declined to re-open the inquiry, giving their detailed reasons for so deciding on March 14, 1960. It therefore fell to the Fay Commission to examine this new evidence, Capt Thain's representations, and to answer the points put by the Minister.

The new light that the report throws on the effect of slush on aircraft performance is the most important aspect of the Fay Commission's work. In particular Appendix 2, by Professor Collar, is a major contribution to the technical literature of aviation safety. Among other things, it suggests that slush drag—contrary to an assumption in the German report—*increases* with speed. The tests described in Appendix 2, to quote the report, "have demonstrated that slush drag is approximately proportional to the square of the aircraft ground speed." As the report notes, there is a "profound difference" between this and the German report's assumptions.

With regard to the three points put by the Minister, the Fay report reads as follows: —

"Having set out the relevant facts and our views on Captain Thain's representations upon disputed questions of fact, we are now in a position to deal with the three questions upon which we are required to give our opinion. The first is whether Captain Thain took sufficient steps to satisfy himself that the wings of the aircraft were free from ice and snow. In forming our views on this question, we have to bear in mind that our task is to consider the steps which Captain Thain took up to the third and last attempted take-off.

"Had the relevant time been that of the first take-off the considerations would have been different. The aircraft first asked for taxi clearance at 1519 hours, and at that time Captain Thain had had recent experience of conditions outside the cockpit. He had not ascertained the recorded temperature, nor himself inspected the upper surface of the wings, but he had had the report, made some 40 minutes earlier, from Captain Rayment, and he himself had seen the water running from the trailing edge. It may be that at that stage his decision not to have the wings swept or de-iced was correct; the decision accorded with Mr Black's

(*Concluded on page 653*)

* "*Report of the Reviewing Body appointed to consider and report upon certain matters connected with the Accident to the Elizabethan Aircraft G-ALZU at Munich on February 6, 1958.*" HMSO, price 8s.

Various seating arrangements for the Westland 192C helicopter, civil version of the Belvedere, are being tried in a mock-up at Weston. Here the inward-facing high-density seats are occupied by Mr A. McClements (right), deputy chief engineer, Bristol Division; Mr J. D. Sibley (centre), chief aerodynamicist; and Mark Lambert of "Flight." The high-density seating will allow for 23 occupants, and either inward-facing or forward-facing seats can be provided for 17 first-class passengers. Headroom is 6ft 2in and width is 4in more than that of the RAF Belvedere. See below

"Flight" photograph

AIR COMMERCE . . .

WESTLAND 192C DEVELOPMENTS

THE civil version of the Westland (Bristol) 192C will have the same rotor, controls and twin Napier Gazelle turbines as its military counterpart and will thus have single-engined and altitude performance somewhat better than that of the Vertol 107 powered by General Electric T58s. The 1,650 h.p. contingency and 1,450 h.p. intermediate-contingency ratings of the Napier Gazelle are features of standard production engines now going into service in both the Belvedere and the Wessex and give the former power-restoration to maintain sea-level performance at up to 7,000ft. At gross weight the Belvedere can hover in the ground cushion on one engine and can be translated to climbing speed from the hover, after failure of one engine, with a height loss of less than 50ft. The "good" engine automatically provides the full transmission power after an engine failure, leaving the pilot without asymmetric handling and with no control adjustments to make.

VC11 GO AHEAD?

A EUROPEAN source last week reported that the British Aircraft Corporation "is now expected to go ahead with development and production of the 100-138 seater VC11." Though it is understood that BAC have as yet made no decision to go ahead with this project, which for the past year has been shown to interested airlines (one of the most interested being TCA), it is still believed to be very much to the fore in BAC's thoughts about future projects.

An order from TCA is believed to be in the "probable" rather than, as hitherto, the "possible" category.

MORE BABY JETS

IT is reported that Piaggio have signed a tentative agreement with Douglas for the manufacture of two "DC-8/108" twin-jet executive aircraft, followed by a possible production run of 90. The project is said to depend on whether the Italian Air Force will finance the two prototypes.

Meanwhile, it is reported that SAAC 23 is the designation of a proposed US/Swiss twin-jet 6/7-passenger executive project (two GE J85s of 2,000lb thrust or two Continental J69s of 1,700lb) being financed by Mr William Lear (of Lear Inc). Production would be subcontracted to a number of European manufacturers and production airframes shipped to the US for installation of engines, instrumentation and interior furnishings, though the two prototypes would be assembled, flight-tested and FAA-certificated in Switzerland by Flug-und-Fahrzeugwerke. Deliveries are planned for 1963, and price would be about $250,000. First flight would be in December 1961.

The SAAC 23 was designed by Dr Hans Studer, formerly of Flug-und-Fahrzeugwerke, and it is to have a cruising speed of 535 m.p.h. at 30,000ft and a range of 1,500 miles with allowances.

At Belfast two members of the design office of Short's Light Aircraft Division have just built and flown this evidently high-fidelity 1/10th scale model of the SC.7 Skyvan. It flies very well on its two Fox 15 engines, and control-line trials indicate "remarkable dynamic similarity" to the real thing—which is due to fly next June. The builders are Robert Carlisle, left, and Paul Stafford

SUPERSONIC STUDY

ACCORDING to a story in the *Daily Express* last Monday the Minister of Aviation was expected this week to announce that the long-awaited supersonic airliner design study contract—valued by the newspaper at about £500,000—is to be awarded to the British Aircraft Corporation. There was no indication as *Flight* went to press that the Minister of Aviation would, in fact, make such an announcement. The report suggests that the design study will, as expected, relate to a Mach 2.2 light alloy narrow-delta airliner seating about 100.

The British Aircraft Corporation, says the report, "would guarantee to have the airliner for transatlantic service with BOAC by 1970 and believes it might be done by 1968 if necessary." At the same time it would pay five to ten per cent of the total development costs which are estimated at about £50 million. The Government would find the rest and would give a guarantee against cancellation for reasons other than the company's technical failure.

The *Express* refers to "scepticism"—presumably in the industry—over the Government's insistence on efforts to seek international co-operation with France and the US.

BALPA AND MUNICH

COMMENTING on the Fay Commission's report on the Munich accident (pages 651 and 653), BALPA say that the criticisms of the German report made by the Association have been justified. "The German inquiry employed an assumption that drag caused by slush decreased with the speed of the aeroplane. The Fay commission reports that it is now known as a result of research initiated, partly at least, as a result of the Munich accident that the drag caused by slush increases with speed—probably as the square of the speed.

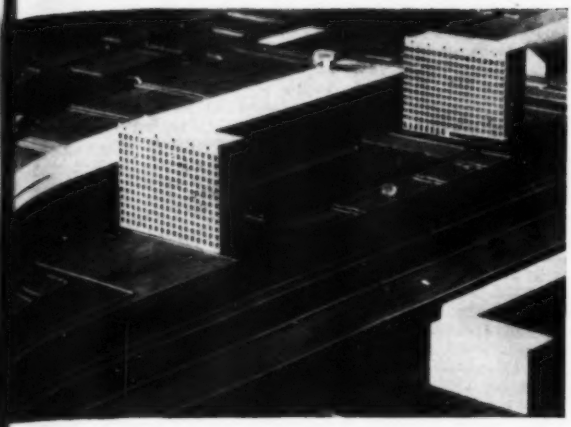
"The Association submits that conclusions should never have been attempted until research had been undertaken. It is for these reasons that the Association has pressed throughout for a re-opening of the inquiry or a review of the available evidence by a body fully qualified to determine the true cause of the accident. The fact that the Fay Commission is unable to say with any degree of certainty that the accident occurred either as a result of wing icing or as a result of the retarding effect of slush even when it has been able to consider a large amount of evidence not available to the German authorities indicates that the cause of the accident is still not established."

BALPA has this to say on the question of the withdrawal of Capt Thain's licence: "The responsibility of a pilot for an accident must be established with a much greater degree of probability before his licence to practise his profession is withdrawn." And of "criticisms that the Association has failed to maintain an objective position in this matter" [probably a reference to criticisms by Capt S. J. L. Key—see *Flight*, September 30, page 551], BALPA says: "It is apparent from the report of the Commission that this criticism cannot be upheld and that all the facts, even those which argued against the case put forward by the Association, were laid before the Commission, an action to which the Commission pays specific tribute."

IAL AND DUBAI

A NEW international civil airport in the Arabian Gulf, planned and managed by International Aeradio on behalf of the Ruler of Dubai, was officially opened on September 30. Dubai is one of the seven Sheikhdoms of the Trucial Oman which has a long history of friendly association with Great Britain.

The opening ceremony was performed by HE Sheikh



Here is a model of what the terminal at Moscow's new airport at Sheremetievo will look like when completed. One of the two blocks in the foreground is said to be intended as the airport's hotel

AIR COMMERCE . . .

Rashid Bin Said Al Maktoum, the Ruler of Dubai, who was received by Mr G. R. Scott-Farnie, CBE, managing director of International Aeradio.

The general layout plans were prepared by IAL and translated into architectural plans by Richard Costain Ltd. The airport has been designed to allow for ease of future expansion. It is capable of receiving aircraft up to and including DC-3s and has a 6,000ft runway, taxi-track, aircraft apron, and terminal building.

UNSUNG HEROES

LITTLE is ever heard about the work of the nine weather ships which comprise ICAO's North Atlantic ocean stations network, and which are supplied or paid for by the 18 ICAO member governments whose airlines fly across the Atlantic. In addition to their primary job of providing surface and upper-air weather information for airline met offices on both sides of the Atlantic, and acting as communications relay points and navigational position aids to *en route* aircraft, these ships also provide search and rescue facilities. Although these facilities were originally intended to deal with airliner emergencies, most of the rescues carried out have, in fact, involved ships in distress. During 1959, according to a report just published by ICAO about its weather ships, nine people were rescued from drowning—seven from ships and two from ditched military aircraft.

In addition these weather stations provided medical assistance to ships 47 times and received ten aeronautical and 574 maritime SOS messages. During their routine functions they made radio contact with 51,577 aircraft and with 14,791 ships; they provided navigational assistance to aircraft flying across the Atlantic in the form of 45,980 radar position fixes, 19,187 non-scheduled radio beacon transmissions (in addition to beacon transmissions made continuously by some of the ships) and 3,396 DF bearings. The jets now flying in increasing numbers between Europe and America require weather information to great altitudes, and all the ocean station weather ships now attain average terminal heights for their radiosonde observations of more than 55,000ft to meet these requirements.

NEW LITERATURE ON SLUSH (continued from page 651)

views, and Mr Black [BEA station engineer at Munich] had had the best opportunity to judge, having been up on the wings throughout refuelling.

"But the time we have to consider is not 1519 hours but 1556 hours, when the Elizabethan reported ready to taxi for the last time. It was then at least 40 minutes and probably longer since Captain Thain had watched the thawed snow falling from the wing, and 78 minutes since refuelling had ceased and anyone had inspected the whole upper surface of the wings. It was also 56 minutes since the screen [airport] temperature had reached zero and within four minutes of the time when the reading was taken as −0.2°. Since the previous decision the aircraft had taxied to one end of the runway, made two runs, and taxied back from the other end and, experiencing whatever temperature variations there might be in its path and having any evaporative cooling accelerated by the forced draught generated by its speed.

"In these circumstances we have no doubt that Captain Thain ought to have made a personal inspection of the wings before reaffirming the decision neither to sweep nor to de-ice. Inspection means obtaining a ladder or stand and examining the top of the wings, not looking at the small portion visible from the cockpit. It is clear from the answers [reproduced in the report] that Captain Thain's omission to take this or any other positive step originated in his ignorance of the ambient temperature, and his failure to acquaint himself with the available information on this subject was, in our view, a serious error. We find that he departed with some snow on his wings, in breach of the BEA instructions; the factors making it impossible for us to say, positively, on the evidence before us whether there was ice under the snow, are factors emphasising the necessity for practical examination at the time.

"Captain Thain had then far less information than we have, and the greater the doubt the greater the necessity for precautions. The facts that he was unfamiliar with Munich, and had had no great experience of weather of the kind in question should also have led him to act with caution. We think it true to say that he had a great deal on his mind, in that he had been unexpectedly confronted with the boost surging; this is a matter which may help to explain his actions, but it cannot affect our finding that to the first question we must return a negative answer.

"In approaching the second question, namely whether Captain Thain took sufficient steps to ascertain whether or not in the conditions prevailing at the time the runway was fit for use, we recognise that for a captain to make a personal inspection of a runway is an extreme and infrequent action. Captain Thain found the runway being used without comment by arriving and departing aircraft, and regarded as safe by the airport authorities; these matters, as he accepts, did not absolve him from responsibilty, but he was entitled to have regard to them. The duty upon him was perhaps higher than in the case of captains of some other aircraft using the runway that afternoon because of his long take-off run, lengthened by the necessity to correct the boost fluctuation; but, as he said in evidence, Munich was not a marginal airport, and he would have had no reason to suspect that he had not enough runway unless he had possessed a knowledge of the drag effects of slush which was not then available.

"Furthermore, had he made an inspection and found the conditions to be as described by Bartz [Herr Kurt Bartz, Munich airport traffic manager, who inspected the runway after the first two attempted take-offs] he would have rightly accepted the runway as safe, whereas had he noted from the ground as he had from his cockpit, a change in the character of the slush at the two-thirds point along the runway, he could not be expected, in the then prevailing state of knowledge of slush-effects, to have appreciated its significance. We find therefore that he did take sufficient steps to ascertain whether in the prevailing conditions the runway was fit for use."

"The third question is whether Captain Thain took sufficient steps to ascertain the cause of the difficulties encountered on the first two attempts to take off before making a third attempt. This question presents no difficulty. We have no doubt that Captain Thain acted correctly in consulting with the station engineer and that the trouble was correctly diagnosed. We think he acted properly in deciding to make the third attempt."

Capt Thain has expressed himself "extremely gratified" with the Fay findings, and he is reported in a newspaper to have said: "It has highlighted the dangers of slush which no one fully realized before. This accident started research which proved that slush on airport runways has the opposite effect to what everyone used to think. This report shows that the people who died in this accident did not die in vain. That is important to me." [Twenty-three people were killed, including the pilot-in-charge, Capt K. G. Rayment.]

Capt Thain's Licence. A Ministry of Aviation official, confirming that Capt Thain (who has been suspended by BEA, though on full pay, since the accident) had been notified that his licence can now be renewed, added: "Although the Minister has accepted that Captain Thain failed to take sufficient steps to satisfy himself that the wings were free from snow and ice and therefore did not fully carry out his responsibilities under the Air Navigation Order as captain of the aircraft, the Minister has decided that in view of the lapse of time, which exceeds any period of suspension which the Minister might have imposed, Captain Thain may, if he applies, requalify for his licence."

BALPA's Position. The organization primarily responsible for persuading the Ministry of Aviation to set up the Fay Commission on the "scope of the inquiry and the clarity of the report," and accepts its findings. But the pilots' association is "seriously disturbed" by the state of affairs to which the commission's report draws attention. A note on BALPA's reactions appears on page 652.

Visitors to Westland last week were the chairman of New Zealand International Airways, Sir Leonard Isitt (second from left) and his general manager, Capt J. J. Busch (second from the right). Also in the picture are (left) Mr H. J. Penrose, Westland's sales manager and Col Richardson, Westland's London manager. Sir Leonard flew by Widgeon from Westland's London heliport to White Waltham, where he talked about the Rotodyne, and then on to Yeovil for general discussions about airline helicopter equipment

AIR COMMERCE . . .

URGENCY AT WEYBRIDGE

BEA and Vickers crews flew 75hr 38min on Vanguard G-APED between October 6 and October 14. On one day the aircraft was airborne for 11¼hr. This intensive flying is part of an "engine assurance" programme to flight test the first set of fully modified production Rolls-Royce Tynes. When it is completed, in about a week's time, this one aircraft will have flown a regular three flights a day for some 200hr. Subsequently the engines are to be inspected by Rolls-Royce and the ARB.

Three other aircraft have been used for flight testing. G-AOYW, the Vickers aircraft, has now nearly completed handling trials and the first two TCA Vanguards, TKA and TKB, are being employed on V.952 certification. Excluding tropical trials, this programme occupies 155hr, of which 120 have now been done. The third Canadian aircraft, TKC, flew on October 6 and will be used for production flight tests only.

Ten Vanguards have now flown, and total hours are 1,622. Four aircraft are awaiting production sets of engines—the rest will arrive in November—but delivery to both BEA and TCA is still expected before the end of the year. TCA should start Vanguard services in January.

COVENTRY HAS A RUNWAY

LAST Saturday, October 15, Lord Brabazon opened Coventry's new 5,300ft runway, thus marking completion of the first phase of this municipally-owned airport's development.

The runway has high and low intensity lighting, and the approach lighting is of the extended centre-line high- and low-intensity type with crossbars. Width is 150ft, with 75ft hard shoulders on each side, and there is a 700ft stopway on the eastern approach and a 600ft stopway on the western approach. The runway is linked with the terminal area by a 400ft taxiway, and three new 130ft by 240ft hangars have been built.

Total cost of this first phase of Coventry airport's development was £182,418. Phase two will be construction of a 4,300ft secondary runway and a full perimeter track; phase three provides for the construction of a new terminal building, additional hangars and extensive aprons, a new approach road and car parks. Phase four envisages the extension of the main runway to 9,000ft.

AN ALTIMETER DISASTER?

THE Austrian civil aviation authorities say that preliminary investigations in Moscow indicate no technical failure in the Austrian Airlines Viscount which crashed on the approach to Moscow Airport on September 26, killing 31 of the occupants. The investigating committee suggests that the accident *might* [our italics] have been due either to misreading of the altimeter or to a fault in the altimeters.

The Austrian investigators' report says: "As the pilots were killed and the altimeters wrecked the exact reason for the aircraft going below the minimum allowable altitude cannot be established. A study of the last radio communications suggested that the crew had believed themselves to be at the right altitude at the beginning of the descent."

BREVITIES

Mr James Mercer, chairman of Ghana Airways, is in Moscow with four colleagues to discuss the airline's proposed purchase of four Ilyushin Il-18s.

The total working population of London Airport is now about 28,000, including Government employees and the staff of 46 airlines and 300 private firms and contractors.

A European source reports that Air Liban will take delivery of a Caravelle this year for service between Beirut and Paris via Rome as from December 20, replacing the DC-6 service.

Cost of modifying its DC-8 fleet with wing-tip extensions to improve L/D and slots to improve C_L max are being considered by Alitalia. The modification would cost about £100,000 per aircraft.

It is reported that Lufthansa are to increase their order for four Boeing 720Bs and they are said also to be evaluating the Canadair CL-44D, two for delivery in 1962 and two more for delivery in 1964.

One of the two D.H. Herons operated by the new Italian independent Itavia crashed on the Island of Elba on October 14 while on a flight from Rome to Genoa. All eleven occupants are reported to have died.

Of the two Viscount 810s recently sold by Continental Air Lines (*Flight* last week), one was bought by Ansett-ANA and the other by Tennessee Gas Transmission Corp for executive use.

Later this month Rolls-Royce Dart 510s in BEA Viscounts are expected to be approved for a 3,000hr overhaul life. Meanwhile the life of BEA's Comet 4B Rolls-Royce Avon engines is expected shortly to go up from 1,300hr to 1,600hr.

According to latest reports United Air Lines and Eastern Air Lines have now signed letters of intent for 40 Boeing 727s each. It is said also that Pan American might buy 20 for use in Latin America. Latest price of the 727 is £1.5m ($4.2m), and delivery date is November 1963.

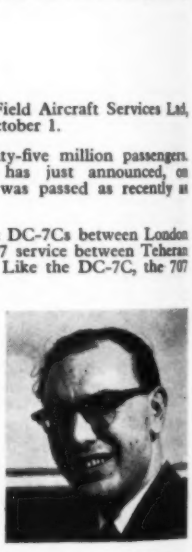
United Kingdom scheduled air traffic in August, the Ministry of Aviation provisionally estimates, showed an increase of 21 per cent compared with August last year. About 59 million ton-miles were operated; load factor fell by one percentage point to 64 per cent.

The Fokker Friendship order book reached 85 last week when Sudan Airways signed for three aircraft of the RDa.7 version. This was the second Fokker F.27 order in two weeks, one Freightship having just been ordered by Lufttransport Unternehmen (LTU) with an option on another (see last week's issue). Fokker have delivered 45 aircraft and Fairchild, whose order book stands at 83, have delivered 75.

Mr Derek Lee, commercial manager of Field Aircraft Services Ltd, has been appointed sales director as from October 1.

BEA have now carried more than twenty-five million passengers. This total was reached, Lord Douglas has just announced, on September 27. The twenty million mark was passed as recently as June 1959.

Persian Air Services, who already operate DC-7Cs between London and Teheran, are to inaugurate a weekly 707 service between Teheran and Brussels via Geneva on November 1. Like the DC-7C, the 707 will be chartered from Sabena.



BEA's senior operational research officer, 32-year-old Mr Alec Lee, has become the first person outside the US to win the Lanchester Prize awarded annually by the Johns Hopkins University of America. For the best paper in English on the subject of operational research ("Some Aspects of a Control and Communications System") he receives $1,000 and a plaque

Transatlantica is the name of a new Argentine operator which, a US source reports, may buy two Boeing 707-420s for operation between Buenos Aires and Geneva via Sao Paulo, Rio, Recife and Lisbon. The airline is reported to be operating two L.1649A Super Constellations.

Subject for discussion at a meeting of the Brough (Blackburn Aircraft) Branch of the RAeS on October 12 was "An Air Bridge for Hull," a paper by Mr M. G. K. Byrne, public relations and publicity manager of the Blackburn Group. Plans for the proposed new Humber Bridge should, in his view, be re-examined in favour of a hovercraft service. A project for a 68-passenger, 70kt hovercraft powered by four Blackburn gas turbines with d.o.c. of 6d per passenger mile was illustrated.

Ten of BOAC's fifteen Boeing 707s have now been delivered, and as from last Sunday, October 16 (when Comet 4s were superseded on the North Atlantic route) schedules to New York via Manchester, Prestwick and Boston were introduced. According to BOAC, 50 per cent more seats were sold in the first ten days of October for the North Atlantic route than in the same period last year—the result of the cheap 17-day excursions introduced on October 1.

PIA Profile

(continued from page 632)

In the first place, Pakistan has little to offer Britain in the way of traffic rights, the bilateral agreement providing practically no restriction on capacity. Control of rights through Pakistan to the east is a valuable bargaining counter in the world air traffic horse-trade, and concessions to PanAm may ease PIA's problems later when, as they eventually intend, a request is made to extend their London service across the Atlantic to New York. Secondly, PIA do not, at the moment, wish to function within the protective cover of a pooling umbrella—an arrangement which was implied in preliminary negotiations between the Pakistan airline and BOAC. Tentative terms offered by the corporation at a time when the majority of passengers between London and Karachi travelled BOAC were a 50/50 division of passenger revenues and a freight division of 70/30. Since PIA hope to capitalize on their domestic route pattern, local knowledge, and the hold capacity of the 707 to carry 90 per cent of the freight on this route, BOAC's offer was turned down as unrealistic.

While admitting that their freight business "is still not organized," between July 1959 and June 1960 freight on PIA's London service increased by one and a half times. Moreover more terminating passengers were carried each week this summer between London and Karachi on PIA's single Boeing and two Constellation services than on the nine Comet and Britannia through services offered by BOAC, Boeing load factors having built up from an initial 35 per cent on the single service to about 65 per cent.

Asked about his airline's attitude to the tripartite Commonwealth pool, Air Cdre Nur Khan said that "although we must eventually join in with this or some other pool, before we do so we must first increase our confidence in BOAC. SAS desperately wants traffic rights in Pakistan, and we have had to restrict KLM to five services and about 60 passengers per week. If we were to expand we might have to cut them out. So it might be easier to combine with them or with another consortium such as Air Union [Lufthansa, Alitalia, Air France and TAI already advertise jointly in Pakistan], and with some other pool I might get a better deal.

"Although we must pool eventually, we should have gone into the BOAC/Air-India/Qantas partnership from a position of weakness. Our sales people are very keen and later we should be in a better position to negotiate. I am frightened of our slacking off and the airline losing its identity."

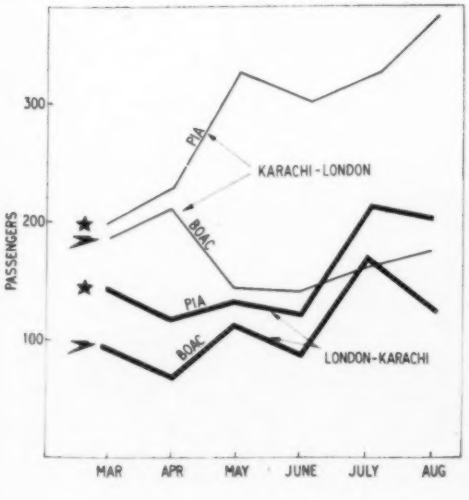
First, the managing director added, PIA would like a technical agreement on the lines of that operated by SAS and Swissair, since "to operate entirely on our own may be a little costly. The question of whether we should order by ourselves or tie-in with some large operator is one which is yet to be decided." This is the province of a recently appointed planning group, who are to report in about six months. Under the provisions of the agreement with PanAm PIA could eventually buy out its Boeing 707-320. The attraction here is that part of the payments made to PanAm could be offset against the purchase price, but first this must be weighed against the continued operation of an Intercontinental 707 over what are not really more than medium-stage hauls. London, Geneva, Rome, Teheran—at all these points PIA has traffic rights; only at Beirut have negotiations yet to be completed, but a gentleman's agreement exists with Sheikh Alamuddin, and MEA may pool with PIA on Beirut - Karachi.

Bilaterals have also been concluded with Germany and Egypt, so that Frankfurt with its freight and business potential, and Cairo, with Islamic associations, may eventually feature on the airline's jet route map. If these sectors are on the short side for a Boeing Intercontinental—and competition for seats on these stages is intense—some other type might suit PIA better, say a Boeing 720B or perhaps a Convair 880. PIA's dilemma is to find one aeroplane for hauls of 400 to 4,000 miles, with which they could operate across the Atlantic and operate also on their domestic services. As nothing of the sort exists, an 80-85 seater with 10,000lb freight capacity and a 2,000 n.m. range would be the nearest compromise. This, they say, is virtually the paper DC-9, although if the choice was for a domestic-routes aeroplane only, nothing could be more suitable than the Vanguard. The present Boeing operation is the major influencing factor in the purchasing decision of the future—when the L.1049Cs are replaced, say, in 1962 or 1963.

Early experience of full utilization of the Boeing as a three-times-a-week service has not been over-encouraging, first load factors reaching barely 20-30 per cent. Of course, profitable operation from an immediate doubling of capacity in the October off season is not to be expected; the budgeted loss for the first six months is seven lakhs (£53,000), or the amount of *additional* profit that was made in the eight months of trip lease.

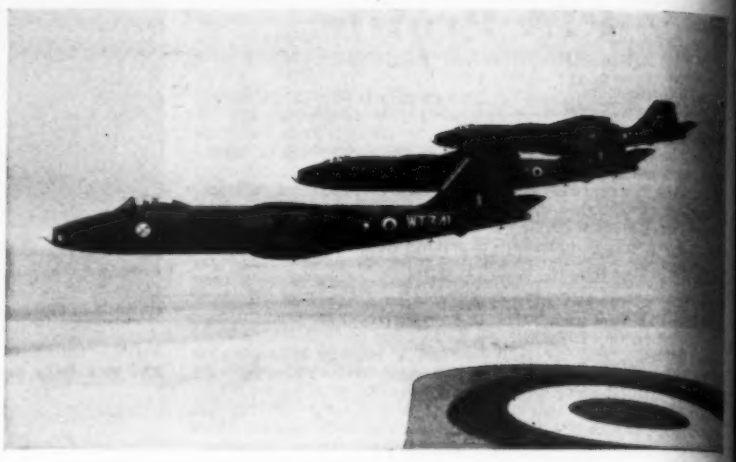
Can PIA again fly into profit on its international services? There seem to be three reasons for thinking that it can. First, the experience of trip lease, in which passenger and freight load factors built up in seven months to a satisfactory level, could again be repeated. Inspired by a managing director of unusual energy—even for airline circles—PIA's morale is very high, notably among the sales force. Secondly, PIA's unique bargain with PanAm allows for a step-by-step transference of engineering responsibility, so that the big technical jump of jet operations is to some extent under outside control. Finally, PIA's staff have something special to offer their passengers: a centuries-old tradition of hospitality applied to all departments of international airline service.

Finishing touches to PIA's new headquarters building at Karachi Airport were being made last week. It houses the administrative staff and technical training school



(Left) Pakistan DCA figures for BOAC and PIA passengers to Karachi. For BOAC this is all sector traffic

The interior of PIA's Boeing 707 is identical with that of PanAm aircraft, although most references to prior ownership are deleted



Interdicter Canberras of RAF Germany: a B(I).8 of No 16 Sqn (commanded by Wg Cdr J. R. Forsythe and based at Laarbruch) leading two B(I).6s of No 213 Sqn (Wg Cdr P. J. Bayley; based at Bruggen)

SERVICE AVIATION

Air Force, Naval and Army Flying News

MEAF Queen's Colour

AT RAF Akrotiri in Cyprus last Friday the Duke of Gloucester presented on behalf of the Queen the Queen's Colour for the Middle East Air Force, the first colour ever presented to a Command of the RAF at home or overseas. During the ceremony, there was a fly-past by Canberras of the MEAF light bomber wing and Hunters of Fighter Command. Air Marshal Sir William MacDonald, AOC-in-C, replied to the Duke of Gloucester's speech, which paid tribute to the traditions established by the RAF in the Middle East during two world wars.

23 Group Change

FOLLOWING the appointment of AVM C. Scragg as Deputy Controller (RAF) within the Air Controllerate of the Ministry of Aviation, he is being succeeded by Air Cdre W. E. Coles (with the acting rank of air vice-marshal) as AOC No 23 Group, Flying Training Command.

Air Cdre Coles has been SASO at No 3 Group, Bomber Command, since December 1957 and before assuming that post took the IDC course. During the war he was a specialist in aerial supply-dropping, and when commanding No 233 Sqn won the DSO for operations over Arnhem. He is also a CBE and holds the DFC and AFC.

RAAF Re-Equipment

IT is reported from Australia that the RAAF mission which toured the world earlier this year to look for a suitable replacement for the Avon-powered Sabres at present operated by RAAF fighter squadrons has recommended purchase of the Dassault Mirage IIIC. This recommendation has been accepted by the Air Board and now goes to the Ministers for Defence and Supply for approval. The final decision rests with the Cabinet. An alternative choice was the Lockheed F-104G, and it is believed the Cabinet may still favour this aircraft, in spite of the RAAF decision, in view of the existing integration with the US on defence equipment.

This integration is seen in practice in the recent announcement of the purchase for the RAAF, through the US Navy, of twelve Lockheed P2V-7 Neptune anti-submarine aircraft. Deliveries are to be made between January and April 1962. Neptune 5s have been used by the RAAF since 1951.

RNZAF Transport Aircraft

CONTRADICTORY statements have recently been made, according to a correspondent, about new transport aircraft for the RNZAF to replace its present Hastings. The NZ Minister of Defence, Mr Connolly, has recently said that he would not agree to the RNZAF buying three DC-6s from TEAL after they had been replaced by Electras. These DC-6s have been offered for £NZ600,000 and the RNZAF has already four pilots and four flight engineers flying in DC-6s with TEAL for experience. This was announced by the Chief of the Air Staff, AVM Calder, who said that if these aircraft were bought they would be operated by No 40 Sqn.

The Minister of Defence wants the RNZAF to have C-130 Hercules aircraft for transport duties. In his view, the DC-6s are too old and too light for the task of troop-carrying in an emergency; New Zealand had been buying too much second-hand equipment and it was time "we gave our chaps a break."

The situation is apparently complicated by the RNZAF requirement for a Sunderland replacement. AVM Calder wants maritime aircraft and considers that the most suitable flying boats would be the Martin P5M-1 or P5M-2. Both are being evaluated. Mr Connolly is apparently more inclined to the idea of buying the US Navy's MR version of the Electra.

Maintenance Command HQ

AT noon next Wednesday (October 26) the foundation stone of RAF Maintenance Command's new headquarters will be laid at Amport, Andover, Hants, by the AOC-in-C, Air Marshal Sir Douglas Jackman. This new building will be the first specially designed as an RAF Command headquarters since the war. It is scheduled for completion in May 1961.

IN BRIEF

The Air Minister, Mr George Ward, has appointed Mr J. Roberts as his principal private secretary.

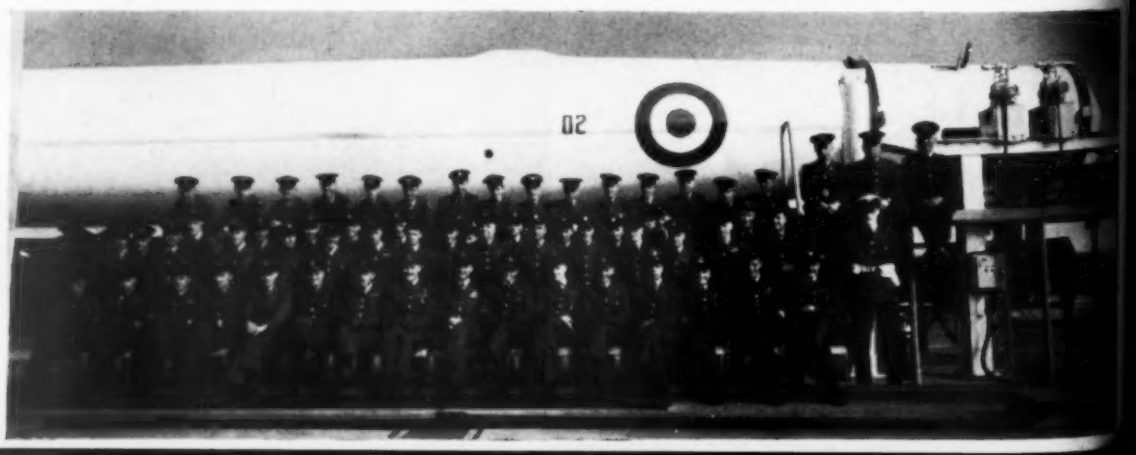
RNAS Worthy Down, near Winchester, is being transferred to the Royal Army Pay Corps from December 1. It has been occupied by the Royal Navy for over 21 years.

Sgt R. A. Barnett of RAF Waddington has been awarded £25 by the AOC-in-C, Bomber Command, for inventing a device to safeguard the nosewheel assembly of Vulcans during ground towing.

Four Metropolitan Area groups of the Royal Observer Corps—Nos 1 (Maidstone), 2 (Horsham), 4 (Colchester) and 5 (Watford)—were engaged on October 9 in Observe Wun, a nuclear fallout exercise.

Capt Aubrey Ford, Commodore of the Air Ministry's fleet of ocean weather ships and Master of the OWS *Weather Reporter*, completes his 100th voyage in AM weather ships when he berths at Greenock next Monday.

Officers and men of No 220 (SM) Sqn, equipped with three Thor missiles. The CO is Sqn Ldr F. R. Leatherdale, DFC



ANNEX

XI